PART 1

REPORT OF THE WORKING GROUP ON THE ASSESSMENT OF SOUTHERN SHELF DEMERSAL STOCKS

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ICES Headquarters

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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TABLE OF CONTENTS

Section Page

1. INTRODUCTION

1.1 Participants

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1.2 Terms of Reference

It was decided at the 82nd Annual Science Conference (C. Res. 1994/2:6:15) that the Working Group on the Assessment of Southern Shelf Demersal Stocks (Chairman: B. Mesnil, France) would meet at ICES Headquarters from 5-14 September 1995 to:

a) assess the status of and provide catch options for 1996 for stocks of cod, whiting, plaice and sole in Divisions VIIe-k, and sole in Sub-area VIII;

b) provide information on the state of exploitation and, where possible, provide catch and management options for hake stocks in Sub-areas III, IV, VI, VII, VIII and IX and for stocks of anglerfish and megrim in Sub-areas VII, VIII and IX;

c) for those stocks and/or fisheries where data permit, provide the information required for ACFM to give advice or guidance on:

   i. medium-term management objectives (in terms of spawning stock biomass and mortality rates) and options;
   ii. the appropriateness of controls on catch (or landings) and fishing effort;
   iii. the potential for multispecies and multiannual catch options.

d) if possible, evaluate options for technical measures appropriate to the fisheries, taking into account technical interactions between the component fleets and species;

e) evaluate the stock units used in the assessments in the area covered by this Working Group and identify any changes required.

The above terms of reference are set up to provide ACFM with the information required to respond to the requests for advice from the North-East Atlantic Fisheries Commission and the European Commission.

1.3 Overview

This year, the Working Group encountered a major problem as the French administration failed to provide the 1994 catch and effort statistics by Division for three major ports of Brittany, whose fleets make considerable catches from the Celtic Sea and Bay of Biscay stocks, among others. For each relevant species, the landings in these ports have been approximately split by stock. However, there was no satisfactory way of estimating the length and age compositions of these landings that would be appropriate to each stock or to each fishery unit. For some stocks, the fleets for which catch and effort data are missing for 1994 usually had a predominant weight in the VPA tuning and, without these data, any assessment is seriously flawed.

According to available information, there are still problems with the treatment of the 1995 catch data for these ports, and the Group is likely to be faced with the same data deficiencies next year. Such a recurring problem with fisheries statistics raises serious concerns about the ability of the Group to continue its work in future, and, more generally, about the efficacy of the TAC system for regulating fisheries.

The Group considered the issue of the appropriateness of stocks' definitions as presently used (Section 2.3), but the available information did not enable firm conclusions to be drawn. If ACFM does decide to merge stocks that are currently assessed by different Groups, a decision will also have to be made about the Group who will have to deal with the 'new' stock.

Data on cod and whiting in the Western Channel (Division VIIe) are still insufficient for the status of this stock to be assessed.

The SSB of Western Channel sole peaked at a high value in 1980 and has substantially declined until 1989 since when it has stabilised. The year classes 1986-88 were below average, and this assessment revised the 1989 year class downwards. SSB is predicted to increase slightly above the current low level in the short-term.

The SSB of Western Channel plaice has been decreasing rapidly from the high values in 1988-90 to well below average, as an effect of fairly high fishing mortalities, notably in the last five years. A few recent year-classes are below average. SSB and landings are predicted to remain close to the 1994 value in the short-term at the current level of F. A better control of fishing mortality would be afforded by a specific TAC for this stock which, at present, is regulated by a TAC that combines the much larger Eastern Channel stock.

Catches and SSB of Celtic Sea cod peaked in 1989, due to the contribution of the very strong 1986 year class, and have subsequently declined sharply. They have increased again in the last three years due to the good 1990 and 1991 year classes, but are predicted to resume their decline as these year classes are rapidly fished out at the current high level of fishing mortality.

The good 1990, 1991 and 1992 year classes of Celtic Sea whiting resulted in an increase of catches and SSB in the last three years. Fishing mortality has been consistently high (in excess of 1.0 until 1992). This, combined with a poor 1993 year-class, is expected to result in a decrease of SSB in 1996-97 to the average level. Fishing mortalities on Celtic Sea cod and whiting, which are taken in the same fishery, should be significantly reduced to maintain SSB's and catch rates above their average levels. This implies that specific TAC's should apply to Divisions VIIf-h.

Fishing mortality on Celtic Sea sole has steadily increased from 1972 to 1990, then decreased. SSB has been gradually decreasing to a low value in 1991 (about half the level in the 1970s) then temporarily increased due to the outstanding 1989 year class. It is predicted to decrease again in 1996-97 to just above the historical low.

The SSB of Celtic Sea plaice has declined since the peak value in 1988 to below average in 1994, but remains above the record low level. Fishing mortality is close to the high value observed in 1990. All recruitments following the strong 1986 year class have been below average. SSB is predicted to remain close to the current low level in 1995-1997 under *status quo* F. Plaice is taken in mixed fisheries and as by-catch by trawlers targeting sole, and management measures should be considered accordingly.

Additional data on cod, whiting, sole and plaice in Divisions VIIb,c,h-k have been made available, but these are still insufficient for assessment purposes.

Due to errors in the length- and age-compositions (of discards, particularly) for 1994, the Group has been unable to provide a reliable assessment for the northern stock of hake. However, previous assessments have indicated that the decrease of SSB was a matter of concern.

The landings of anglerfish (*Lophius piscatorius*) in Sub-areas VII and VIII have decreased steadily between 1985 and 1993, but increased in 1994, whereas fishing mortality has been generally increasing during that period. Good recent year classes have halted the decline of SSB and landings which are predicted to increase in the short term.

The landings and SSB of *Lophius budegassa* in Sub-areas VII and VIII have decreased steadily since 1989, and SSB reached a minimum in 1994. It is expected to remain close to that low level in the short term at the current level of F.

Apart from an apparent peak in 1991, fishing mortality on megrim in Sub-areas VII and VIII is moderate. SSB has been steadily increasing since the low value in 1990 and is predicted to increase above 100,000 t in the short term at current level of F. A large proportion of the catch is discarded, and undersized fish make a large fraction of the landings.

The stock of sole in the Bay of Biscay has been capable of supporting the rapid expansion of the fishery and the continuous increase of fishing mortality in the recent years, because the exploitation pattern has been improving in the same time and recruitment was stable. However, this compensation is reaching its limits. The 1991 and 1992 year classes are below average and the 1993 year class is by far the weakest on record. At current levels of F, SSB is expected to decrease in the short-term to the lowest level ever recorded.

The state of the southern stock of hake continues to be a matter of concern. Following a sharp decline between 1984 and 1986, SSB has remained at a low level, reaching a new minimum in 1994, and recruitment has been decreasing continuously until 1992, with a slight improvement in 1993. If the objective is to rebuild SSB, fishing mortality has to be reduced considerably. The exploitation pattern needs also to be improved.

Age-based assessments of the anglerfish (*Lophius piscatorius* and *Lophius budegassa*) in Divisions VIIIc and IXa have again been attempted this year, but the results are very sensitive to changes in VPA options and could not provide a reliable basis for forecasts and advice. Given the problems with ageing of these fish, a different modelling approach should be considered. The trends in commercial catch rates for large fish were examined. They indicate that SSB of both species has declined during the last decade and is currently at a low level. The TAC's agreed for these stocks have consistently been well above actual catch possibilities.

Catches of *Lepidorhombus boscii*, the most abundant of the two species of megrim in Divisions VIIIc and IXa, have been decreasing since 1989, and stabilised in 1993-94. Recruitment has been decreasing and the 1993 year class recruited in 1994 is exceptionally weak. In the last three years, SSB has been low and is predicted to remain at that level under current levels of F.

The catches of *Lepidorhombus whiffiagonis* from Divisions VIIIc and IXa in 1993 were about 40% of what they were in 1990, but have slightly increased in 1994. The assessment gave very different results depending on the tuning options and was not considered sufficiently reliable as a basis for advice. However, the available evidence points to a very weak 1993 year class

and to a low level of SSB in recent years. The TACs which apply to both species of megrim combined have been far above actual catch possibilities.

Key results of the assessment are summarised in Table 1.1.

1.4 Data Deficiencies

There has been a major problem with the French data this year, as the log-books for 1994 for the ports of Lorient and Douarnenez (all year), and of Concarneau (last 6 months) have not been processed, if they were collected at all. This means that the corresponding catch and effort data by Division, gear and vessel type were not provided to the French scientists. The fleets from these ports make a large proportion of the catch from several of the Celtic Sea and Bay of Biscay stocks, and also fish in other areas, notably in Sub-area VI.

For the assessments, the first requirement is to allocate the total landings of each species in these ports, which are available from the sales records, to individual Divisions or assessment areas. For this Group, the main difficulty is with cod and whiting, which are caught by these fleets in several areas. This is also true for anglerfish and megrim, although the landings from Sub-areas VII and VIII usually predominate. In contrast, the hake landings into the Brittany harbours can safely be allocated entirely to the extensive northern stock, and these ports account for only a marginal part of the catches from the Bay of Biscay sole stock. For each species concerned, attempts were made to estimate the landings for the stock areas dealt with by the Group, using the same proportions by Division for each port and month as observed in previous years. However, this introduces a first level of approximation in view of the changes in the structures of the fleets and in the spatial distribution of their activities.

Table 1.2 shows, for each stock, the amount of unrecorded landings that had to be estimated, and the proportion of the total catch that it represents. The severity of the problem in terms of misallocation among assessment areas is also indicated. It should be noted, however, that the actual error or impact on the assessment is much lower than indicated by the percentages.

The next problem is to estimate the length or age distributions of these estimated landings. Although the market records also include the detail by commercial categories for each species and month, there is no satisfactory procedure to estimate the amount of each category taken in each Division. Using the same allocation by Divisions for each category as in previous year(s) implies that the relative abundance by size remains the same through time, an assumption which may not be upheld. The consequence is that the weights to which the length samples, which are taken by market categories, should be raised cannot be estimated with confidence. Information is also lacking to enable these catches to be allocated to fishery units (i.e. by gear type and depth stratum in addition to area), thus it is not possible to raise the length compositions by fishery units estimated for the other fleets. The last resort would be to raise the international length or age compositions to account for these catches, but this is not satisfactory (different patterns of fishing and mixes of gears, areas and seasons), in addition to the fact that the missing landings are estimates of unknown precision. It is all the more risky when the latter are a large component of the total catch.

This lack of data becomes critical when the fleets in question are part of the tuning fleets. Because their effort cannot be estimated, they must be discounted, which creates a particular problem when they usually have a large weight in the final estimations. In principle, XSA accepts missing data, but it is clear that the uncertainties in the assessment and the predictions increase when these occur in the terminal year of the VPA.

A major reason for concern is that, according to available information, the problem is very likely to be encountered again next year. In the same Brittany ports, the collection and treatment of log-books for the first months of 1995 is still far from complete. In view of the changes that are taking place in the French Atlantic fleets due to economic difficulties, the procedures used this year to fill the gaps, by referring to a previous year with "hard" data, will clearly become invalid. In addition, this extra work on basic data represents a call on scientists' time at the expense of research. It also delays considerably the availability of data for exploratory runs, which are the only way of detecting and correcting possible errors (see the case of northern hake). It is also frustrating that the replacement of missing data by scientists' estimates is often used as an excuse to question the assessments and the advice based on them.

The ability of the Group, and in consequence of ACFM, to make assessments and provide advice for several stocks is precarious. This situation raises serious questions on how a TAC system of fisheries regulation can be expected to achieve its aims when countries do not put in place appropriate means of accounting their catches against their quotas which, in addition, is supposed to be made in real time.

1.5 Methodology and Software

1.5.1 Standard assessment

XSA has been the only method used for VPA tuning in all final assessments, using the version implemented in IFAP. The procedures used to screen the data and to select the tuning options were described in detail in last year's report and are not repeated here.

One difference to note is that, as requested by ACFM, the plots of residuals by fleet and age presented in the report are from the final XSA fit, rather than from preparatory work. In relation to this, considerable time has been wasted in obtaining these plots, which at the moment requires transferring pieces of the XSA diagnostics files into a spreadsheet and setting up all the graphs. A more automatic procedure would facilitate the work.

In some instances, the Group has been less restrictive regarding the range of ages for which catchability might be dependent on abundance. Previously, this was confined to the first age in the data, provided it could be based on reliable recruitment data. The criteria considered this year were the value of the t-statistics, the improvement of the standard errors and/or whether there was a significant improvement in the retrospective pattern. The 'treatment as recruits' was carefully avoided, however, when the CPUE series were too short or lacked contrast.

One problem identified by the Group is related to the definition of status quo and to the standard practice of scaling the recent exploitation pattern to the mean F in the terminal year. In one instance (northern hake), the data for some ages in the terminal year were doubtful and gave an anomalous estimate of mean F in 1994. Scaling to that value would have had the effect of propagating the error into the prediction, whereas a straight average of recent Fs might have smoothed the error out. When XSA was introduced to replace the Laurec-Shepherd method, it was claimed that one of its advantages is that it no longer treats the data for the terminal year as exact. In a sense, the scaling procedure is equivalent to treating the final estimate as exact and is a move in the opposite direction. In an other instance (Biscay sole), the fishery has recently expanded without restriction, exceeding the TAC each year, and fishing mortality increases year after year. If status quo is defined as the latest F value, which is revised upwards each year, the advice based on status quo predictions is bound to simply track and endorse the intensification of exploitation, rather than to stabilise it. It is no surprise that predictions (notably for the medium-term) are significantly revised each year when what is called status quo F in a year is systematically x% larger than what it was the year before. In such instances, it would be preferable to agree on a reference (set of) year(s) and base the TAC recommendations on the results of predictions at the corresponding (mean) level of F.

1.5.2 IFAP

The Group appreciates that several changes in IFAP suggested in its previous reports have been implemented, notably the calculation of mean weights of the plus-group for predictions and the facility for editing the tuning fleets' data.

However, the work would be facilitated if the production of standard graphs was made more automatic, notably regarding:

- the plots of log-catchability residuals by fleets from XSA;
- the stock-recruitment plots and, possibly, the calculation of Fmed, etc.;
- the yield-per-recruit and forecasts for landings and discards.

In addition to difficulties for setting up the corresponding graphs, performing retrospective analyses in the system remains problematical.

1.5.3 Risk analyses and medium-term simulations

Three methods were used this year for risk analyses and/or medium-term predictions.

- The Monte Carlo method (Mesnil, 1993 after Restrepo *et al.*, 1992) was described in last year's report. It is recalled that it considers errors on natural mortality, on catches at age and on CPUE data. Frequency distributions of the conventional assessment results are obtained on completion of many replicates which involve: random perturbations of the data; VPA tuning using the ADAPT framework (Gavaris, 1988); Y/R analysis; short- and medium-term predictions of landings and SSB with a choice of options for recruitment and F levels. There has been no change in the implementation, except for the correction of a small error in the estimation of parameters for the Ricker stock-recruitment relationship. This year, the method has only been applied to Bay of Biscay sole.

- The set of programs developed by R. Cook for the Working Group on North Sea Demersal Stocks (Cook., 1993) was also available. However, since most members of this Group had no previous experience with the methods and programs, it was considered imprudent to use them without appropriate knowledge. The sensitivity analysis method was thus only applied to the Celtic Sea sole data (but the program for medium-term predictions handles units which are too large for this "small" stock).

- The @RISK add-on to Excel spreadsheet was used for stochastic medium-term predictions for the southern stock of hake. It is an easy tool but the calculations in a spreadsheet are difficult to validate.

It is desirable that members of the Group make themselves familiar with the use of these methods on their data during the year, so that they can be put into practice during meetings.

1.6 General Comments on Management Options

The issues listed in terms of reference c) have already been discussed in a number of working groups and committees, and there is little to add to what has already been said. In addition to the specific management considerations discussed in individual stocks' sections, some general features apply to all stocks.

It has long been recognised that a major difficulty for the management of the Southern Shelf fisheries and resources, by whichever kind of measure, is related to the fact that most stocks are exploited in mixed fisheries. This has two aspects:

i. each stock is fished by a variety of métiers (vessel and gear type, location) characterised by particular exploitation patterns, fishing powers and efficiencies, social and economic constraints, etc.
ii. although a métier can be targeted at a particular species or group of species, its fishing operations can, intentionally or otherwise, generate fishing mortality upon other stocks inhabiting the same grounds.

In this context, one of the problems which has been identified with the TAC system, as it exists in the EU, is the requirement to set TAC's that are compatible among stocks fished by the same fleets. If TAC's imply different levels of fishing intensity, the closure of the fishery for a stock when its TAC is attained does not prevent vessels continuing fishing in the area as long as the TAC's for other species allow. This results in discarding or misreporting catches from the "closed" stock rather than in the intended reduction of fishing mortality.

In principle, a system in which an adequate level of effort is allocated to each métier is likely to be more effective in reducing the problem of incidental catches. However, setting adequate effort levels may be just as arduous as making TAC's compatible: if the state of individual stocks call for differing degrees of regulation, managers and the industry have to decide which species have to be privileged, protected or sacrificed. On the technical side, another problem with effort control in a fishery with several métiers is to estimate the appropriate relationship between the target fishing mortality or SSB and the effort that can be attributed to each métier, taking into account its particular exploitation pattern and efficiency. The problem is further compounded when this has to be done for all relevant species. In addition, it does not seem economically sensible or socially acceptable to freeze vessels in their current métiers. Not only would standardisation factors between fleets or métiers have to be monitored to keep track of gains in efficiency, but also the balance between métiers would need to be frequently re-evaluated as the structure of the fleets and the state of the various stocks change.

Regarding the options of multi-annual or multispecies TAC's, a problem already raised by several Working Groups is that these notions are still ambiguous (particularly as interpreted by the industry), and managers should give more indications on what they actually mean: is it a matter of deciding in a given year what suite of TAC figures will apply to a period of subsequent years, or of a planned reduction in F, or of establishing decision rules whereby the TAC is, for example, some agreed function of the SSB estimated each year?

Anyway, the appropriateness of these options cannot be evaluated as long as they are only defined generically: the whole package of measures associated with each system must be specified. For multispecies TAC's, for example, what measures are envisaged to avoid fishing down the most valuable species, in decreasing order ? For multi-annual TAC's, to what extent would roll-over of uncaught quota be allowed, and what rules would apply when the quota in a given year is exceeded ? When we see that, in the current system, there is still a lack of planning of quota consumption within the year, as evidenced by early closures that often seem to be unanticipated, there may be concerns that multi-annual TAC's, in the form of present figures, may give the illusion that restrictions may be deferred and problems solved later. Another issue relates to allowances for revisions: the possibility of adjusting the rules or the targets must exist in case the situation of the resources evolves quite differently from what was anticipated, but if this ends up in annual (or more frequent) requests for scientists to re-evaluate the procedures/options, there will be no improvement to the current system.

1.7 Duration of Meetings

When this Working Group was established, it was faced with several difficulties:

- the large numbers of stocks for which assessments are required;
- for several members, a lack of experience with age-based assessment methods and software;
- data in the appropriate format were often not available or only for short time series;
- the requirement to produce a report in English, which poses particular problems for most members.

In addition, the first years coincided with the introduction of XSA and of IFAP.

The first difficulty has resulted in the imperative requirement that all data should be prepared in advance of the meeting. This Group has been particularly successful in this regard and, as members gained experience with the assessment methods, a lot of the preparatory work of data exploration, trial runs with different options, retrospective analyses, etc. is now done prior to the meetings. Nevertheless, this material has to

be reviewed by the Group so that options for the final VPA can be agreed. This usually takes the first 3 days of the meeting, including the opening session, a quick review of the state of the data, a thorough check of the data stored in IFAP, and the circulation of the material to be examined.

The next stage is to agree on the results of the final VPA. This often implies the examination of additional trial runs. About 2 days are required, keeping in mind that some members have to deal with several stocks and the concern that nobody should be lagging behind the rest of the Group. Usually one more day is required to run and agree the predictions, and another day is used for preparing the texts, graphs and tables. Finally, the report and ACFM first drafts are discussed and experience shows that 3 full days are needed, notably in view of the fourth difficulty mentioned above.

In total, the 10 days which have so far been allocated to this Group are well occupied and certainly not excessive. Any reduction would necessarily imply extending the duration of already quite long working days (commonly 10-12 hours), certainly at the expense of quality, unless the terms of reference are radically changed towards less frequent updates of assessments. It should be recalled that this duration has proved just sufficient to address the basic single-stocks assessment work, and has made it impossible to adequately consider in addition the problems of technical interactions for which area-based working groups have been established.

Table 1.1

Summary of stock assessments and catch predictions

STOCK	ASSESSMENT				RECRUITMENT				LONG TERM				STATUS QUO PREDICTION					COMMENTS
		1994			Year				Fmax	Fmed	AM	AM	1995		1996		1997	
	BASIS	LAND'GS	F	SSB	1992	1993	1994	1995			Rec	SSB	LAND'S	SSB	LAND'S	SSB	SSB	
COD VIIe		0.6																No assessment
WHITHING VIIe		1.8																No assessment
SOLE VIIe	XSA	0.7	0.24	3.0	3.3	3.0	3.8	*4.1	0.29	0.25	4.3	3.7	0.7	3.0	0.7	3.1	3.2	SSB stable, low
PLAICE VIIe	XSA	1.2	0.78	1.7	4.8	3.3	4.6	*5.1	0.29	0.62	5.6	2.5	1.2	1.6	1.2	1.5	1.6	SSB remains low
COD VIIf,g,h	XSA	8.5	0.94	10.7	5.8	1.3	*2.5	*2.5	0.29	0.80	3.3	7.9	5.6	6.0	5.5	5.6	5.0	SSB down, high F
WHITING VIIf,g,h	XSA	13.6	0.92	26.8	68.4	48.1	17.8	*33.6	0.35	1.38	37.0	17.4	13.5	22.5	10.0	18.0	17.4	SSB decreasing
SOLE VIIf,g	XSA	1.0	0.50	2.2	4.6	4.2	*4.8	*4.8	0.24	0.33	5.0	3.3	1.0	2.3	1.0	2.2	2.1	SSB decreasing
PLAICE VIIf,g	XSA	1.1	0.83	1.3	3.9	1.9	*5.2	*5.2	0.30	0.65	5.7	1.8	1.1	1.1	1.2	1.0	1.1	SSB remains low
COD VIIb,c		0.6																No assessment
WHITING VIIb,c		1.3																No assessment
SOLE VIIb,c		0.1																No assessment
PLAICE VIIb,c		0.2																No assessment
COD VIIj,k		1.4																No assessment
WHITING VIIj,k		2.9																No assessment
SOLE VIIh,k		0.7																No assessment
PLAICE VIIh,k		0.7																No assessment
HAKE NORTH		51.3																Data problems
L.PISC NORTH	XSA	16.1	0.38	30.4	28.8	33.2	*17	*17	0.13	0.38	21.1	41.9	20.0	40.7	23.1	50.5	55.9	SSB increases
L.BUDE NORTH	XSA	5.8	0.18	32.3	18.4	*15.9	*15.9	*15.9	0.14	0.15	16.0	44.0	5.9	32.0	5.8	32.0	32.1	SSB remains low
MEGRIM NORTH	XSA	13.1	0.21	80.7	269.2	245.4	*250.3	*250.3	0.17	0.32	261.8	75.6	14.7	90.7	16.6	97.3	101.0	Stable
SOLE VIIIa,b	XSA	7.2	0.61	14.4	41.8	15.1	*49.8	*49.8	0.12	0.55	49.1	12.7	6.2	12.8	5.0	8.8	9.1	SSB decreases
HAKE SOUTH	XSA	9.5	0.29	16.6	37.2	65.1	@69.7	@69.8	0.16	0.23	87.0	31.3	8.5	15.1	8.4	13.9	13.2	ILdgs & SSB low
L.PISC SOUTH	XSA	2																VPA unreliable
L.BUDE SOUTH	XSA	1.6																VPA unreliable
M.WHIFF SOUTH	XSA	0.5	0.61	1.0	11.0	2.3	0.1											VPA unreliable
M.BOSCII SOUTH	XSA	1.4	0.30	4.3	42.9	30.0	4.1	*33.8	0.34	0.46	31.2	4.8	1.7	4.9	1.5	4.7	4.8	SSB remains low

Notes :

Recruits in millions

Landings and SSBs in kt.

Recruitment : XSA values unless annotated : * Assumed GM or TG @ AM + RCT3 estimate

Fmax corresponds to maximum of Landings/R

SBL = Safe Biological Limits

NF = Not Found

Table 1.2 Estimates used to replace missing landings data (tonnes).

Species	Area	France Brittany	% Total Catch	Serious ?
Cod	VIIe	57		
Whiting	VIIe	103		
Sole	VIIe	7	0	N
Plaice	VIIe	19	2	N
Cod	VIIf-h	2383	28	Y
Whiting	VIIf-h	5870	43	Y
Sole	VIIf,g	22	2	N
Plaice	VIIf,g	87	8	N
Cod	VIIb,c,j-k			
Whiting	VIIb,c,j-k			
Sole	VIIb,c,h-k			
Plaice	VIIb,c,h-k			
Hake North	IIIa-VIIIa,b	4150	8	N
Megrim(s)	VIIb-k,VIIIa,b	553	20	N
Anglers x2	VIIb-k,VIIIa,b	2329	11	N
Sole	VIIIa,b	245	3	N
Hake South	VIIIc,IXa			
Megrim x2	VIIIc,IXa			
Anglers x2	VIIIc,IXa			

NB: Seriousness here relates to possible misallocation by areas.

2. GENERAL

2.1 Nominal Landings

It is recalled that several stocks assessed by the Group are managed by means of TACs that apply to areas other than those corresponding to individual stocks, notably in Sub-Area VII, or to a combination of species in the cases of anglerfish and megrim. As a consequence, the official landings provided to ICES by statistical offices are of limited relevance for the assessments when they are reported by TAC areas. Moreover, several countries failed to provide catch figures for recent years. Therefore, all official figures by species and area have been grouped under this general section and are given in Tables 2.1.1-7. The figures actually used by the Working Group will be given in the relevant section for each stock.

2.2 Fisheries Trends.

This section is intended to present information about trends in size and effort of fishing fleets, to the extent that their activities impact on several stocks concurrently.

2.2.1 French fleets

Due to lack of statistics for three major ports in 1994 (Section 1.4), the tables on effort trends presented in last year's report could not be updated.

The only consistent series of effort is provided by vessels from Le Guilvinec area. Figure 2.2.1 shows the allocation of their total effort by métier in the Western Approaches. It shows a decrease of the part devoted to benthic (anglerfish and megrim) stocks in recent years, although the decrease is less important for that fleet than for the total French fleets according to the data presented in last year's report. A slight increase of the fishing effort devoted to anglerfish (benthic species) in the Bay of Biscay is noted (Figure 2.1.2). This fleet is not considered representative of the trends in effort directed at gadoids.

There is some evidence that the decrease of fishing effort recorded in 1993 has continued in 1994:

* The number of vessels in the ports bordering Sub-areas VII and VIII has decreased by about 10% (MAGP data). However, the distribution and rate of activity of these vessels are not known.

* The vessels stayed in port during several weeks due to strikes in the first quarter of 1994.

* A governmental report about the viability of the French artisanal fleet has recently concluded that about 300 vessels (over 1000) from the Atlantic ports are in a very critical financial position and that about 100 may be decommissoned.

Table 2.1.1 Nominal landings of COD as reported to ICES (tonnes)

COD VIIb,c

Country	1988	1989	1990	1991	1992	1993	1994
France	591	27,342*[1]	16,366*[1]	8,807*[1]	223*	12,058*[1]	11,497*[1]
Germany, Fed. Rep.	-	1	-	-	-	-	-
Ireland	388	915	795	612	507	357	289
Norway	2	9	29	11	39	+*	7*
UK (England & Wales)	23	9	12	35	64	14	29
UK (N. Ireland)	-	-	-	2	1	2	+
UK (Scotland)	5	33	300	173	145	73	93
Total	1,009						

*Preliminary. [1] Includes VIId,e,f,g-k, VIII, IX, X, COPACE (EC).

COD VIIe

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	12	19	6	6	2	5	1
Denmark	+	+	5	-	1	1[1]	2*
France	1,758	...*[2]	...*[2]	...*[2]	487*	...*[2]	...*[2]
UK (England & Wales)	850	734	618	403	366	274	309
UK (Scotland)	-	2	4	6	1	2	-
Total	2,620						

*Preliminary. [1]Includes VIId. [2]Included in Cod VIIb,c.

COD VIIf

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	440	662	550	262	122	250	281
France	2,255	...*[1]	...*[1]	...*[1]	1,324*	...*[1]	...*[1]
Ireland	-	-	155	73	69	-	-
UK (England & Wales)	278	309	398	351	379	353	308
UK (Isle of Man)	-	-	-	4	4	-	-
UK (N. Ireland)	-	-	2	1	-	-	-
UK (Scotland)	-	2	4	3	+	1	-
Total	2,973						

*Preliminary. [1]Included in Cod VIIb,c.

Table 2.1.1 (Cont'd)

COD VIIg

Country	1988	1989	1990	1991	1992	1993	1994
Belgium[a)]	...	...	...	...	...	...	...
Denmark[a)]	...	-	-	...	-	-	-*
France	7,500	...*1	...*1	...*1	4,312*	...*1	...*1
Ireland	725	387	221	115	130	390	822
Norway[a)]	-	...	...	-	-	...	...
UK (England & Wales)	73	64	146	141	183	166	114
UK (Isle of Man)	-	-	2	5	2	-	-
UK (N. Ireland)	12	5	2	10	7	8	19
UK (Scotland)	-	1	17	6	9	3	4
Total	8,310						

*Preliminary. [a)]See table Cod VIIg-k. [1]Included in Cod VIIb,c.

COD VIIg-k

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	102	229	86	51	81	136	115
Denmark	+	-	-	+	-	-	-*
France	9,460	...*1	...*1	...*1	5,418*	...*1	...*1
Ireland	1,593	1,244	1,285	1,528	1,002	825	1,472
Norway	-	13	20	-	-	-*	-*
UK (England & Wales)	177	192	337	330	461	319	312
UK (Isle of Man)	-	-	2	5	-	-	-
UK (N. Ireland)	12	5	4	10	7	8	19
UK (Scotland)	2	1	139	25	22	7	10
Total	11,346						

*Preliminary. [1]Included in Cod VIIb,c.

Table 2.1.2 Nominal landings of WHITING as reported to ICES (tonnes).

WHITING VIIb,c

Country	1988	1989	1990	1991	1992	1993	1994
France	113	19,771*1	19,348*1	10,006*1	487*	13,697*1	18,614*1
Germany, Fed. Rep.	+	-	-	-	-	-	-
Ireland	922	1,199	770	540	730	826	1,042
UK (England & Wales)	12	1	-	15	17	19	18
UK (N. Ireland)	+	-	-	-	+	2	2
UK (Scotland)	+	32	38	79	150	147	117
Total	1,047						

*Preliminary.

Table 2.1.2 (Cont'd)

WHITING VIIe

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	4	3	4	2	1	2	2
Denmark	-	+	+	-	-	+[1]	+*
France	1,439	...*[2]	...*[2]	...*[2]	876*	...*[2]	...*[2]
UK (England & Wales)	1,183	917	1,344	1,431	931	1,240	1,028
UK (Scotland)	-	5	41	21	1	6	-
Total	2,626						

*Preliminary. [1]Includes VIId. [2]Included in Whiting VIIb,c.

WHITING VIIf

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	136	253	246	259	63	68	176
France	1,579	...*[1]	...*[1]	...*[1]	1,828*	...*[1]	...*[1]
Ireland	-	-	110	75	100	-	-
UK (England & Wales)	174	238	274	292	147	172	225
UK (Isle of Man)	-	-	-	13	3	-	-
UK (N. Ireland)	-	1	1	3	-	-	-
UK (Scotland)	-	-	3	2	+	1	-
Total	1,889						

*Preliminary. [1]Included in Whiting VIIb,c.

WHITING VIIg

Country	1988	1989	1990	1991	1992	1993	1994
Belgium[a)]	...	...	...	...	...	...	...
Denmark[a)]	-	...	-	-	-	-	-
France	7,152	...*[1]	...*[1]	...*[1]	6,599*	...*[1]	...*[1]
Germany, Fed. Rep.[a)]	-	-	...	-	14	-	-
Ireland	265	168	350	260	320	653	1,344
UK (England & Wales)	147	46	104	134	132	133	94
UK (Isle of Man)	-	-	2	5	-	-	-
UK (N. Ireland)	19	1	7	21	11	20	29
UK (Scotland)	-	-	1	20	12	22	10
Total	7,583						

*Preliminary. [a)]See table Whiting VIIg-k. [1]Included in Whiting VIIb,c.

Table 2.1.2 (Cont'd)

WHITING VIIg-k

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	19	39	67	43	47	75	50
Denmark	-	+	-	-	-	-	-*
France	7,929	...*[1]	...*[1]	...*[1]	6,916*	...*[1]	...*[1]
Germany, Fed. Rep.	-	-	+	-	14	-	-
Ireland	2,036	1,651	1,654	1,328	1,775	3,630	5,053
UK (England & Wales)	256	162	151	237	300	344	371
UK (Isle of Man)	-	-	2	5	-	-	-
UK (N. Ireland)	19	1	7	21	11	20	29
UK (Scotland)	1	-	28	32	20	34	16
Total	10,260						

*Preliminary. [1]Included in Whiting VIIb,c.

Table 2.1.3 Nominal landings of PLAICE as reported to ICES (tonnes)

PLAICE VIIb,c

Country	1988	1989	1990	1991	1992	1993	1994
France	9	1*	11*	9*	3*	5*	2*
Ireland	157	159	130	179	180	191	200
UK (England & Wales)	2	2	-	+	6	1	2
UK (Scotland)	+	13	91	3	3	1	3
Total	168						

*Preliminary.

PLAICE VIIe

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	90	89	82	57	25	56	10
Denmark	-	+	2	-	+	+[1]	-*
France	584	3,713[1*]	4,739[1*]	4,082[1*]	419*	2,598[1*]	3,044[1*]
UK (England & Wales)	1,654	1,708	1,873	1,314	1,110	1,080	996
UK (Isle of Man)	-	-	-	-	+	-	-
UK (Scotland)	-	2	18	16	19	24	-
Total	2,328						

*Preliminary. [1]Includes VIId.

Table 2.1.3 (Cont'd)

PLAICE VIIf

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	372	440	493	584	125	198	153
France	142	1,089[1*]	767[1*]	444[1*]	118*	370[1*]	328[1*]
Ireland	-	-	-	-	-	2	-
UK (England & Wales)	516	381	403	324	220	219	194
UK (Isle of Man)	-	-	-	3	1	-	-
UK (N. Ireland)	-	-	1	1	-	-	-
UK (Scotland)	-	-	6	1	3	6	1
Total	1,030						

*Preliminary. [1]Includes VIIg.

PLAICE VIIg

Country	1988	1989	1990	1991	1992	1993	1994
Belgium[a)]	...	...	...	...	...	...	...
Denmark[a)]	...	...	-	...	-	+	-
France	579	...[1*]	...[1*]	...[1*]	386*	...[1*]	...[1*]
Ireland	226	180	160	155	180	87	82
UK (England & Wales)	113	89	85	64	80	71	57
UK (Isle of Man)	-	-	-	1	-	-	-
UK (N. Ireland)	1	1	1	-	-	+	1
UK (Scotland)	-	-	1	-	2	3	-
Total	919						

*Preliminary. [a)]See table Plaice VIIg-k. [1]Included in VIIf.

PLAICE VIIg-k

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	245	403	301	252	246	344	197
Denmark	+	+	-	+	-	+	-*
France	714	229[1*]	77[1*]	173[1*]	90[2*]	84[1*]	46[1*]
Ireland	595	634	498	633	657	470	353
UK (England & Wales)	546	162	173	351	341	289	315
UK (Isle of Man)	-	-	+	1	-	-	-
UK (N. Ireland)	1	1	1	-	+	+	1
UK (Scotland)	1	-	2	+	9	10	1
Total	2,102						

*Preliminary. [1]Reported as VIIh,j,k. [2]Reported as VIIh,j.

Table 2.1.4 Nominal landings of SOLE as reported to ICES (tonnes).

SOLE VIIb,c

Country	1988	1989	1990	1991	1992	1993	1994
France	2	+*	-*	5*	2*	2*	2*
Ireland	34	38	41	46	43	59	60
UK (England & Wales)	1	-	-	-	+	+	+
UK (Scotland)	-	-	+	-	+	-	-
Total	37						

*Preliminary.

SOLE VIIe

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	67	69	41	35	41	59	33
Denmark	-	-	+	-	-	-	-
France	98	112*	81*	325*	267*	220*	261*
Netherlands	-	6	-	-	-	-	-
UK (England & Wales)	784	611	634	476	459	480	546
UK (Isle of Man)	-	-	-	-	+	-	-
UK (Scotland)	-	1	1	1	11	18	-
Total	949						

*Preliminary. [1]Includes VIId.

SOLE VIIf

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	451	431	363	624	231	258	281
France	11	87[1]*	130[1]*	80[1]*	11*	102[1]*	120[1]*
Ireland	-	-	-	-	-	2	-
UK (England & Wales)	284	154	271	340	245	223	200
UK (Isle of Man)	-	-	-	-	+	-	
UK (Scotland)	-	-	1	-	4	8	8
Total	746						

*Preliminary. [1]Includes VIIg.

Table 2.1.4 (Cont'd)

SOLE VIIg

Country	1988	1989	1990	1991	1992	1993	1994
Belgium[a)]	...	...	...	...	...	...	...
France	99	...[1*]	...[1*]	...[1*]	130*	...[1*]	...[1*]
Ireland	72	18	40	32	45	49	37
UK (England & Wales)	33	49	80	64	80	62	64
UK (Isle of Man)	-	-	+	-	-	-	-
UK (N. Ireland)	+	+	-	+	+	+	+
UK (Scotland)	-	-	+[2]	-	2	3	-
Total	204						

*Preliminary. [a)]See table Sole VIIg-k. [1]Included in VIIf. [2]Includes VIIj

SOLE VIIg-k

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	254	252	353	358	312	317	338
France	152	84[1*]	66[1*]	55[1*]	43[3*]	49[1*]	41[1*]
Ireland	254	224	306	338	300	286	221
UK (England & Wales)	199	226	224	296	294	271	236
UK (Isle of Man)	-	-	+	-	-	-	-
UK (N. Ireland)	+	+	-	+	+	+	+
UK (Scotland)	-	-	...[2]	-	5	8	2
Total	859						

*Preliminary. [1]Reported as VIIh,j,k. [2]Included in VIIg. [3]Reported as VIIh,j.

SOLE VIII

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	135	311	301	389	440	400	466
France	4,309	5,471[1*]	5,231[1*]	4,315[1*]	5,919[1*]	5,622[1*]	6,413[1*]
Portugal	7	8	5	3	1	-	-
Spain	+						
UK (England & Wales)	-	-	-	-	-	1	-
Total	4,451						

*Preliminary. [1]Reported as VIIIa,b.

Table 2.1.5 Nominal landings of HAKE as reported to ICES (tonnes)

HAKE IIIa

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	5	3	13	15	15	5	4
Denmark	576	952	1,584	1,623	1,546	1,188	791*
Germany, Fed. Rep.	-	-	-	-	-	1	+
Netherlands	1	-	-	-	-	-	-
Norway	60	56	113	115	154	121*	58*
Sweden	38	50	98	103	141	162	121*
Total	680	1,061	1,808	1,856	1,856	1,477	974

*Preliminary.

HAKE IVa

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	+	+	+	+	1	1	1
Denmark	232	245	336	343	322	478	233*
Faroe Islands	-	-	-	-	-	6	4*
France	380	585[1]*	748[1]*	134[1]*	109*	151[1]*	77[1]*
Germany, Fed. Rep.	30	29	9	19	28	70	51
Netherlands	+	8	1	4	18	4	+
Norway	202	269	420	505	442	459*	241*
Sweden[a)]	33	24	41	138	60	38	30
UK (England & Wales)	67	4	9	13	23	5	3
UK (Isle of Man)	-	-	-	-	+	-	-
UK (N. Ireland)	3	+	-	-	+	-	-
UK (Scotland)	353	188	235	360	412	460	316
Total	1,300						

*Preliminary. [a)]Includes IVb 1988-1993. [1]Includes IIa(EC) and IVb,c.

Table 2.1.5 (Cont'd)

HAKE IVb

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	32	25	78	115	116	69	55
Denmark	790[1]	860[2]	934[3]	1,374[4]	1,500	1,512	1,103[5]*
France	1	...[a]*	...[a]*	...[a]*	12*	...[a]*	...[a]*
Germany, Fed. Rep.	8	5	13	11	22	48	28
Netherlands	149	117	89	81	162	135	74
Norway	2	2	2	8	2	+*	4*
Sweden[a]	...	...	...	...	...	...	19
UK (England & Wales)	18	15	16	24	47	30	33
UK (Isle of Man)	-	-	-	-	+	-	-
UK (N. Ireland)	-	-	-	+	+	1	1
UK (Scotland)	34	31	30	54	37	22	27
Total	1,034						

*Preliminary. [a]Included in IVa 1988-1993. [1]Includes 12 t reported as Sub-area IV. [2]Includes 4 t reported as Sub-area IV. [3]Includes 11 t reported as Sub-area IV. [4]Includes 7 t reported as Sub-area IV. [5]Includes 3 t reported as Sub-area IV.

HAKE IVc

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	6	5	1	2	1	2	1
Denmark	+	+	1	1	+	+	+*
France	-	...[1]*	...[1]*	...[1]*	1*	...[1]*	...[1]*
Germany, Fed. Rep.	-	-	-	-	-	+	+
Netherlands	4	-	1	1	2	1	1
UK (England & Wales)	2	1	-	1	4	+	1
UK (Scotland)	-	-	+	+	+	+	-
Total	12						

*Preliminary. [1]Included in IVa.

Table 2.1.5 (Cont'd)

HAKE VIa

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	2	2	-	+	-	1	+
Denmark	+	+	+	+	+	1	+*
France	1,909	9,417[1]*	6,539[1]*	3,162[1]*	1,197*	3,261[1]*	2,500[1]*
Germany, Fed. Rep.	2	2	+	+	+	1	+
Ireland	265	730	207	151	241	251	244
Netherlands	-	-	14	3	-	-	-
Norway	5	1	+	+	+	+*	1*
Spain	1,340						
UK (England & Wales)	1,169	506	279	497	452	467	507
UK (Isle of Man)	-	+	-	-	+	-	-
UK (N. Ireland)	83	77	115	278	283	173	117
UK (Scotland)	1,329	1,380	1,399	1,692	1,340	1,392	1,079
Total	6,104						

*Preliminary. [1]Includes Vb(EC), VIb and VII.

HAKE VIb

Country	1988	1989	1990	1991	1992	1993	1994
France	-	...[1]*	...[1]*	...[1]*	-*	...[1]*	...[1]*
Ireland	-	-	115	76	102	1	+
Norway	-	-	+	1	-	+*	+*
Spain	1,336						
UK (England & Wales)	75	8	16	1	7	35	22
UK (N. Ireland)	-	+	+	3	+	1	-
UK (Scotland)	5	6	12	15	7	19	25
Total	1,416						

*Preliminary. [1]Included in VIa.

Table 2.1.5 (Cont'd)

HAKE VIIa

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	17	19	16	6	10	7	5
France	187	...[1]*	...[1]*	...[1]*	61*	...[1]*	...[1]*
Ireland	237	321	106	85	122	242	225
UK (England & Wales)	186	284	139	77	95	154	542
UK (Isle of Man)	2	7	8	15	7	7	25
UK (N. Ireland)	523	1,024	1,336	1,042	736	644	479
UK (Scotland)	202	117	84	68	35	54	52
Total	1,354						

*Preliminary. [1]Included in VIa.

HAKE VIIb,c

Country	1988	1989	1990	1991	1992	1993	1994
France	478	...[1]*	...[1]*	...[1]*	69*	...[1]*	...[1]*
Germany, Fed. Rep.	-	-	-	-	-	-	6
Ireland	128	89	219	133	196	424	250
Netherlands	-	-	-	7	-	4	-
Norway	-	-	+	+	1	-*	-*
Spain	4,033						
UK (England & Wales)	859	207	157	223	598	471	373
UK (N. Ireland)	2	-	-	1	2	12	1
UK (Scotland)	8	3	10	38	116	172	142
Total	5,508						

*Preliminary. [1]Included in VIa.

HAKE VIId

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	26	1	1	2	3	1	2
Denmark	-	-	-	-	+	-	+*
France	4	...[1]*	...[1]*	...[1]*	4*	...[1]*	...[1]*
UK (England & Wales)	2	3	3	3	1	1	5
UK (Scotland)	-	-	-	-	+	+	+
Total	32						

*Preliminary. [1]Included in VIa.

Table 2.1.5 (Cont'd)

HAKE VIIe

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	3	3	1	+	+	1	+
Denmark	-	-	-	-	-	-	+*
France	1,185	...[1]*	...[1]*	...[1]*	503*	...[1]*	...[1]*
Ireland	-	-	-	11	11	-	-
UK (England & Wales)	329	353	439	506	293	266	253
UK (Scotland)	-	1	9	-	+	1	-
Total	1,517						

*Preliminary. [1]Included in VIa.

HAKE VIIf

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	30	35	28	10	12	10	11
France	551	...[1]*	...[1]*	...[1]*	296*	...[1]*	...[1]*
Ireland	-	-	26	16	30	-	-
UK (England & Wales)	505	502	296	265	174	295	235
UK (Isle of Man)	-	-	-	3	+	-	-
UK (N. Ireland)	-	-	-	1	-	-	-
UK (Scotland)	-	16	9	6	-	+	-
Total	1,086						

*Preliminary. [1]Included in VIa.

HAKE VIIg-k

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	16	29	19	8	11	13	9
Denmark	+	-	+	+	-	-	-*
France	3,332	...[1]*	...[1]*	...[1]*	1,579*	...[1]*	...[1]*
Ireland	1,331	965	1,593	1,301	1,812	1,621	1,456
Netherlands	-	4	-	15	-	-	-
Norway	-	-	+	-	-	-*	-*
Spain	5,229						
UK (England & Wales)	2,539	1,189	1,499	2,274	2,730	2,318	2,233
UK (Isle of Man)	-	-	+	-	-	-	-
UK (N. Ireland)	+	+	2	1	1	12	1
UK (Scotland)	1	9	17	214	166	302	267
Total	12,448						

*Preliminary. [1]Included in VIa.

Table 2.1.5 (Cont'd)

HAKE VIII

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	2	15	8	12	13	7	18
Denmark	-	-	-	-	+	-	-*
France	13,853	13,678[1]*	12,979[2]*	15,607[3]*	11,426[4]*	8,972[5]*	11,854[6]*
Ireland	-	2	-	-	-	-	-
Netherlands	-	-	28	-	-	-	-
Portugal	23	21	20	23	37	16	45
Spain	13,630						
UK (England & Wales)	2	-	-	-	+	-	-
Total	27,510						

*Preliminary. [1]VIIIa,b,d,e 13,663 t; VIIIc, IX, X, COPACE(EC) 15 t. [2]VIIIa,b,d,e 12,977 t; VIIIc, IX, X COPACE (EC) 2 t. [3]VIIIa,b,d,e 15,591 t; VIIIc, IX, X, COPACE(EC) 16 t. [4]VIIIa,b 11,284 t, VIIIc 19 t, VIIId 119 t and VIIIe 4 t. [5]VIIIa,b,d,e 8,957 t; VIIIc, IX, X, COPACE(EC) 15 t. [6]VIIIa,b,d,e 11,688 t; VIIIc, IX, X, COPACE(EC) 166 t.

HAKE IX

Country	1988	1989	1990	1991	1992	1993	1994
Portugal	5,469	3,111	3,074	3,564	4,582	2,647	2,184
Spain	6,060						
Total	11,529						

*Preliminary.

Table 2.1.6 Nominal landings of ANGLERFISH (species combined) as reported to ICES (tonnes).

ANGLER VIIa

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	52	130	103	28	61	65	139
France	134	...[1]*	...[1]*	...[1]*	97*	...[1]*	...[1]*
Ireland	417	1,418	87	80	103	450	385
UK (England & Wales)	209	269	143	90	151	162	309
UK (Isle of Man)	9	28	38	35	2	16	22
UK (N. Ireland)	356	620	417	234	303	329	228
UK (Scotland)	42	419	439	135	133	321	115
Total	1,219						

*Preliminary. [1]Included in VIIg-k.

Table 2.1.6 (Cont'd)

ANGLER VIIb,c

Country	1988	1989	1990	1991	1992	1993	1994
France	308	...[1]*	...[1]*	...[1]*	165*	...[1]*	...[1]*
Germany, Fed. Rep.	-	-	-	-	-	87	53
Ireland	173	146	473	686	467	284	409
Netherlands	-	-	-	3	-	-	-
Norway	-	1	2	1	3	-*	2*
Spain	779						
UK (England & Wales)	331	50	157	418	581	284	258
UK (N. Ireland)	1	-	-	8	5	44	3
UK (Scotland)	13	127	203	79	178	257	165
Total	1,605						

*Preliminary. [1]Included in VIIg-k.

ANGLER VIId

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	102	120	47	35	19	23	30
Denmark	-	-	-	-	+	-	+*
France	63	...[1]*	...[1]*	...[1]*	16*	...[1]*	...[1]*
Netherlands	3	-	-	-	-	-	-
UK (England & Wales)	49	120	76	40	80	71	49
UK (Scotland)	-	-	-	-	2	-	+
Total	217						

*Preliminary. [1]Included in VIIg-k.

ANGLER VIIe

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	133	189	43	4	5	12	14
Denmark	-	+	-	-	+	-	-*
France	1,879	...[1]*	...[1]*	...[1]*	1,908*	...[1]*	...[1]*
UK (England & Wales)	1,786	2,102	1,322	639	536	601	694
UK (Isle of Man)	-	-	-	-	+	-	-
UK (Scotland)	-	4	7	-	-	-	-
Total	3,798						

*Preliminary. [1]Included in VIIg-k.

Table 2.1.6 (Cont'd)

ANGLER VIIf

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	130	268	121	39	42	100	224
Denmark	1	1	-	-	+	-	-*
France	183	...[1]*	...[1]*	...[1]*	155*	...[1]*	...[1]*
Ireland	-	-	28	36	38	-	12
UK (England & Wales)	461	488	370	387	372	470	350
UK (Isle of Man)	-	-	-	-	+	-	-
UK (Scotland)	-	-	1	-	+	-	-
Total	775						

*Preliminary. [1]Included in VIIg-k.

ANGLER VIIg-k

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	86	343	114	26	56	152	348
Denmark	15	9	7	10	2	1	-*
France	6,791	11,445[1]*	10,921[1]*	8,818[1]*	5,271*	6,976[1]*	8,455[1]*
Germany, Fed. Rep.	-	-	-	-	-	40	38
Ireland	1,239	948	1,897	1,748	1,972	1,104	1,291
Norway	-	2	1	-	-	-*	-*
Spain	576						
UK (England & Wales)	2,038	1,606	1,782	1,896	2,238	1,731	1,240
UK (Isle of Man)	-	-	+	-	-	-	-
UK (N. Ireland)	1	2	+	-	1	1	2
UK (Scotland)	3	2	27	74	101	100	96
Total	10,749						

*Preliminary. [1]Includes VIIa-VIIf.

ANGLER VIII

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	12	124	28	13	10	29	95
France	6,274	5,442[1]*	6,268[1]*	4,516[1]*	3,256[2]*	3,212[1]*	4,053[1]*
Germany, Fed. Rep.	-	-	-	-	-	-	2
Ireland	-	2	-	-	-	-	-
Portugal	2	+	1	1	1	-	1
Spain	5,691						
UK (England & Wales)	2	2	-	2	1	+	-
UK (N. Ireland)	-	-	-	-	-	1	-
Total	11,981						

*Preliminary. [1]Excluding VIIIe, including IX, X, COPACE(EC). [2]VIIIa,b 3,151 t, VIIIc 16 t and VIIId 89 t.

Table 2.1.6 (Cont'd)

ANGLER IX

Country	1988	1989	1990	1991	1992	1993	1994
Portugal	1,920	1,673	1,943	1,965	1,892	158	66
Spain	3,042						
Total	4,962						

*Preliminary.

Table 2.1.7 Nominal landings of MEGRIM (species combined) as reported to ICES (tonnes)

MEGRIM VIIa

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	11	13	18	4	6	3	6
France	39	...[1]*	...[1]*	...[1]*	50*	...[1]*	...[1]*
Ireland	168	813	143	180	179	346	187
UK (England & Wales)	53	24	10	10	64	53	51
UK (Isle of Man)	-	-	+	-	+	-	-
UK (N. Ireland)	27	2	3	9	22	18	29
UK (Scotland)	3	97	79	60	51	70	54
Total	301						

*Preliminary. [1]Included in VIIg-k.

MEGRIM VIIb,c

Country	1988	1989	1990	1991	1992	1993	1994
France	111	...[1]*	...[1]*	...[1]*	46*	...[1]*	...[1]*
Germany, Fed. Rep.	+	-	-	-	-	-	
Ireland	203	212	364	370	381	479	616
Netherlands	-	-	-	1	-	-	-
Spain	1,288						
UK (England & Wales)	183	26	29	96	187	197	178
UK (N. Ireland)	2	-	-	1	3	8	1
UK (Scotland)	6	37	51	34	67	70	70
Total	1,793						

*Preliminary. [1]Included in VIIg-k.

MEGRIM VIId

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	1	8	2	2	+	+	1
France	-	...[1]*	...[1]*	...[1]*	-*	...[1]*	...[1]*
Ireland	-	-	-	-	-	-	7
UK (England & Wales)	2	11	2	1	1	1	8
UK (Scotland)	-	-	-	-	3	-	-
Total	3						

*Preliminary. [1]Included in VIIg-k.

Table 2.1.7 (Cont'd)

MEGRIM VIIe

Country	1988	1989	1990	1991	1992	1993	1994*
Belgium	7	12	1	+	+	1	1
France	303	...[1]*	...[1]*	...[1]*	168*	...[1]*	...[1]
Ireland	-	-	-	10	10	-	-
UK (England & Wales)	371	284	285	305	220	218	356
UK (Isle of Man)	-	-	-	-	+	-	-
UK (Scotland)	-	3	4	1	-	-	-
Total	681						

*Preliminary. [1]Included in VIIg-k.

MEGRIM VIIf

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	92	108	72	15	26	14	39
France	104	...[1]*	...[1]*	...[1]*	89*	...[1]*	...[1]*
Ireland	-	-	84	70	81	-	-
UK (England & Wales)	83	108	118	123	158	162	175
UK (Isle of Man)	-	-	-	-	+	-	-
UK (Scotland)	-	-	1	-	-	-	-
Total	279						

*Preliminary. [1]Included in VIIg-k.

MEGRIM VIIg-k

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	71	148	68	16	26	25	76
France	3,498	4,705[1]*	4,047[1]*	2,683[1]*	2,915*	3,119[1]*	2,656[1]*
Ireland	1,638	1,654	1,970	1,914	2,040	1,716	1,763
Spain	2,050						
UK (England & Wales)	1,329	1,035	860	1,103	1,423	1,588	1,601
UK (Isle of Man)	-	-	+	-	-	-	-
UK (N. Ireland)	2	+	-	-	+	+	2
UK (Scotland)	5	-	1	16	24	36	35
Total	8,593						

*Preliminary. [1]Includes VIIa-VIIf.

Table 2.1.7 (Cont'd)

MEGRIM VIII

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	3	33	6	1	+	+	2
France	1,178	1,109[1*]	955[1*]	1,091[1*]	905[2*]	746[1*]	727[1*]
Ireland	-	1	-	-	-	-	-
Portugal	2	-	2	2	2	1	2
Spain	4,060						
UK (England & Wales)	-	-	-	1	1	-	-
Total	5,243						

*Preliminary. [1]Including IX, X, COPACE(EC). [2]VIIIa,b 886 t, VIIIc 1 t and VIIId 18 t.

MEGRIM IX

Country	1988	1989	1990	1991	1992	1993	1994
Portugal	306	410	329	226	218	17	11
Spain	3,506						
Total	3,812						

*Preliminary.

Figure 2.1.1 Fishing effort by metier for Guilvinec vessels in the Western Approaches.

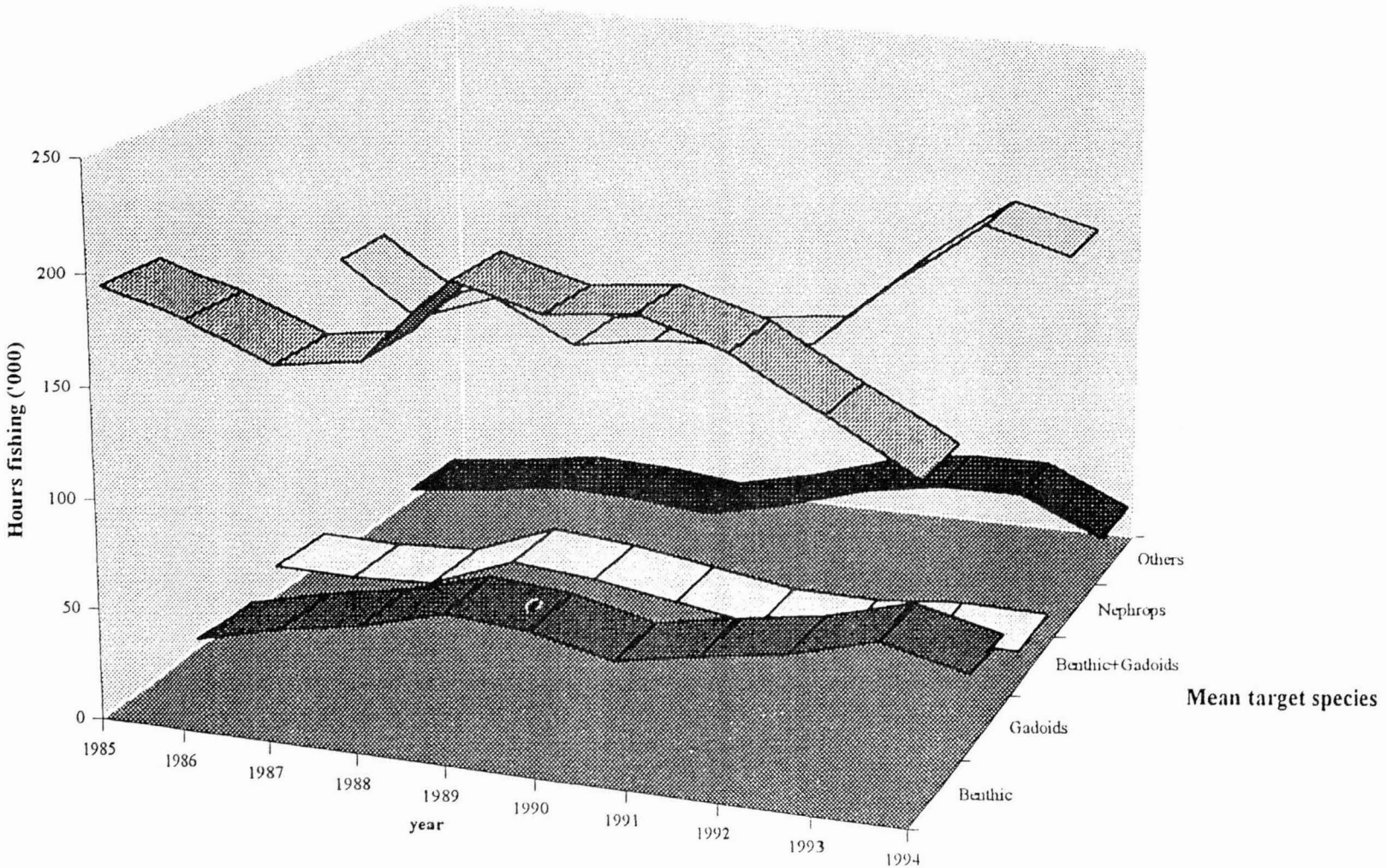
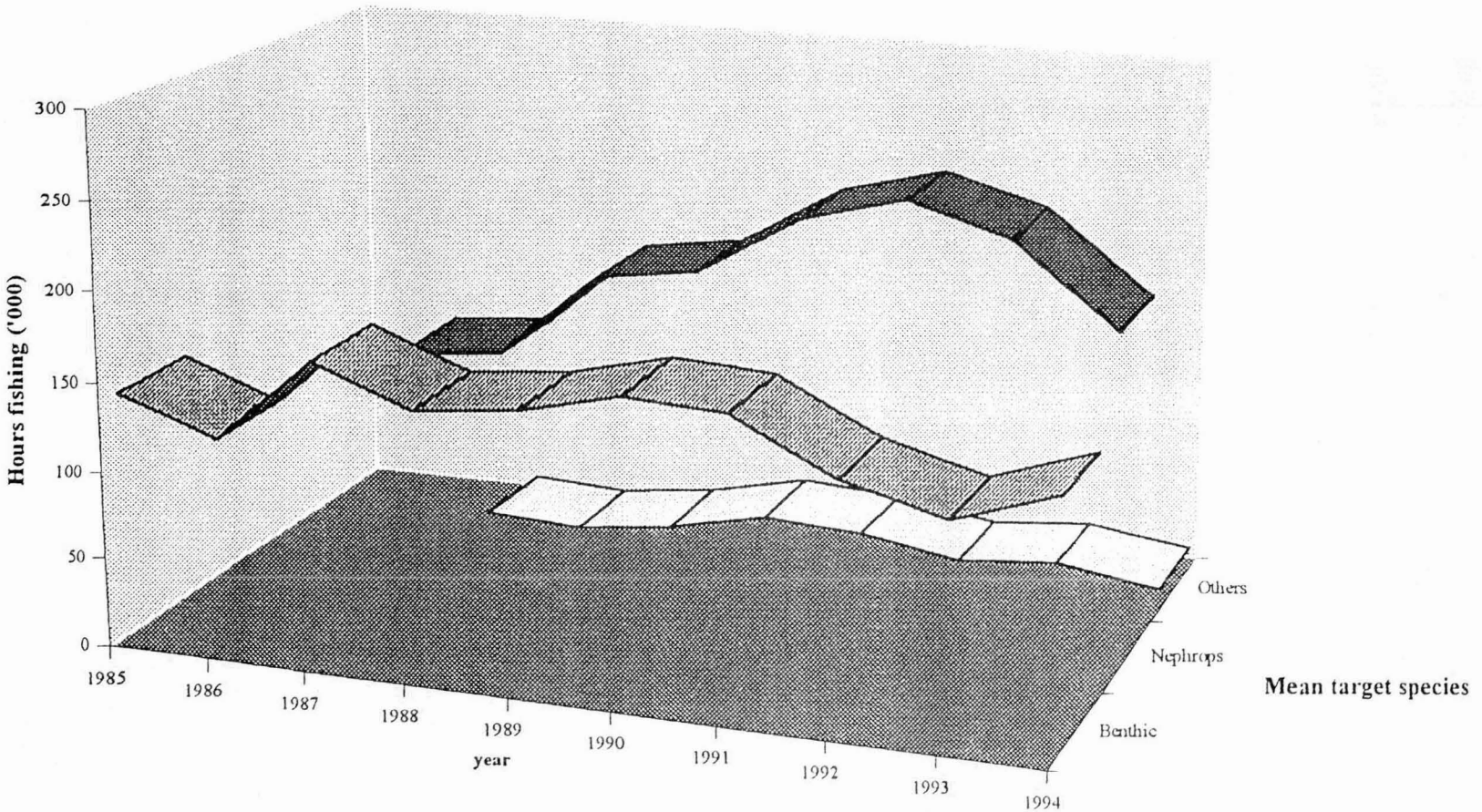


Figure 2.1.2 Fishing effort by metier for Guilvinec vessles in the Bay of Biscay



2.2.2 Spanish fleets

The Spanish fleets involved in demersal fisheries in the North-eastern Atlantic waters operate from Division IXa to Sub-area VI. Due to the very different characteristics of the vessels and the constraints on their activity in relation to the different sea areas, the Spanish fleets will be described separately for the different geographical areas.

2.2.2.1 Fleets in Sub-areas VI, VII and Divisions VIIIa,b,d

Spanish vessels can be assigned to the following Fishery Units as defined by the ICES Working Group on Fisheries Units in Sub-areas VII and VIII in 1985 :

Unit 1 Longlines in medium-deep waters, in Sub-area VII

Unit 4 Non-*Nephrops* trawl in medium-deep waters, in Sub-area VII

Unit 12 Longlines in medium-deep waters in Sub-area VIII

Unit 14 Non-*Nephrops* trawl in medium-deep waters, in Sub-area VIII

Unit 16 Miscellaneous vessels (trawl & longlines in medium-deep waters), in Sub-area VI

As also occurs in other countries, the number of Spanish vessels by fishery unit is difficult to estimate with precision. It is usual that many vessels must change fishing area within a year or a quarter, in order to comply with the official licences allocated for one or another Sub-area. In some cases, gear changes also occur over the years. The sum of the number of vessels in each fishery unit may often be higher than the actual number of vessels, because some (or many) of them may have been counted several times if they fished in several fishery units or Sub-areas. Even if a vessel has been present in a fishing unit for only a very short period, it will be included in that fishery unit's estimate. The total "operative" fleet was the sum of vessels present in all the fishing units in a particular year. For this reason, the total number of "operative" Spanish vessels may appear to be more than 300.

The figure of 300 is the fixed number of Spanish nominal vessels ("base list") allowed to fish in the Sub-areas VI, VII (except in the "Irish Box") and Divisions VIIIa,b,d, since the accession of Spain to the EC/UE, in 1986. Only 150 of these vessels are licensed to fish simultaneously, according to the following rates in the different sea areas: 23 vessels in Division Vb and Sub-area VI, 70 in Sub-area VII and 57 in Divisions VIIIa,b,d.

The Spanish fleets in the northern demersal fisheries are composed of trawlers and longliners. The duration of their trips varies considerably, depending mainly on the fishing area, but also on the gear and the base port. Mean trip total duration in Divisions VIIIa,b,d is about 5-7 days for trawlers and 12 days for long liners (of which 1-3 days are spent steaming to and from the fishing grounds), about 17 days in Sub-area VII (4-6 days for travel), and about 21 days in Sub-area VI (7/8 days for travel).

Since 1986, more than 40 vessels have been destroyed and only a very few vessels have been launched/constructed to replace them.

Trawl fleet

Traditionally, the bottom trawl fleet is composed of vessels that fish individually ("bakas" and "bous") and those that fish in pairs ("parejas"). In 1994, the proportion of each of these three trawl fleet component was: 86% of "bakas", 10% of "bous" and 4% of "parejas".

The main differences between "bakas" and "bous" are the height of the net mouth (it is higher in the "bous"), the fishing grounds (the "bous" fish in deeper waters and nearer to the edge of the shelf), and the target species (the "bous" are more focused and restricted to hake than the "bakas"). The duration of their hauls/trawls is about three hours for "bous" and four or more hours for "bakas". The mean over-all length, the mean engine power and the mean tonnage tend to be larger in the "bous".

The traditional bottom pair trawlers (usually composed by two old "bakas") have disappeared in the last years, but new bottom pair trawlers have worked since 1993. These vessels achieve a high vertical aperture in the net mouth and they are very effective for their target species (hake). For this reason, their fishing effort is not comparable with that traditional pair trawlers.

The characteristics of the trawl fleet during 1990-94 are presented in Table 2.2.1.a), though the data are split neither in relation to the fleet components nor to the fishing areas. This is because the same vessels sometimes go to fish in different areas, according to the temporary distribution of the licences.

The target species for trawlers are hake, megrim, anglerfish and, at a lesser level, *Nephrops*. By-catches are pout, ling and blue ling, witch, molluscs (octopus, squids,...), mullets, and horse mackerel among others.

Effort data related to the most representative ports' fleets operating in Sub-area VII and Divisions VIIIa,b,d are used to tune the VPAs for hake, megrim, anglerfish (and *Nephrops*) stocks. The fishing effort evolution of the Spanish fleets in those ports is

presented in Table 2.2.2. All these fleets represent more than 80 % of total Spanish vessels fishing in Sub-area VII.

In general, effort of trawlers ("bous" and "bacas") fishing in Sub-Areas VI, VII and Divisions VIIIa,b,d show a constant decrease (for "bakas" since 1990-91 and for "bous" since 1992), which is consistent with the reduction in the number of boats.

Longlines fleet

This fleet has three components: one is the typical offshore fleet that always fishes in Divisions VIIIa,b,d or in Sub-areas VI and VII; the second one is an inshore fleet that usually fishes in Spanish coastal waters of Division VIIIc, but temporary operates in Divisions VIIIa,b,d; and the third one corresponds to the artisanal fleet that works in the Spanish waters of Division VIIIb.

The "typical offshore" longliner vessels are larger and more powerful (HP); their number and names are registered in the "300 base list"; they can fish in Sub-areas VI, VII or Divisions VIIIa,b,d. The trip duration is between 12 and 21 days (4-8 days are required to travel) according to the situation of the fishing area.

On the other hand, the "temporary offshore" longliner fleet is composed of vessels that may differ in number and identity from one to the next year. They are smaller in engine power, tonnage and length-over-all, and are restricted to fish in Divisions VIIIa,b,d. The trip duration in the fishing area is shorter, about 7 days.

In addition, a number of inshore longline (artisanal) vessels fish all year in the Spanish coastal waters of Division VIIIb. These vessels are characterised by their smaller dimensions and by the short duration of their trips (always less than one day).

In order to put in perspective the different entity of these three longlines components, the approximate average values for the Basque Country fleet in 1994 are presented:

- "Typical offshore longliners":
Number= 22; Length-over-all= 30 m; GRT= 223 t; Engine power= 798 HP; Age= 23 y

- "Temporary offshore longliners":
Number= 15; Length-over-all= 21 m; GRT= 69 t; Engine power= 363 HP; Age= 15 y

- "Artisanal longliners in Division VIIIb":
Number= 26; Length-over-all= 16 m; GRT= 35 t; Engine power= 214 HP; Age= 20 y

Table 2.2.1.b) gives the characteristics of the total "operative" long-line Spanish fleet (excepting the artisanal longliners in Division VIIIb) in the period 1990-94, without the data being split either in relation to the fleet components nor in the fishing areas.

The main target species for longliners is always hake. Important catches of ling, blue ling, conger, pout, forkbeards, are also taken.

2.2.2.2 Fleets in Divisions VIIIc and IXa

During the Southern Hake Task Force (SHTF) held in Lisbon, Portugal, in October 1994 (Anon. 1994d), data on the fleets involved in catching mainly hake in Divisions VIIIc and IXa were collected. A resume of the Spanish fleets' description is presented here.

The Spanish fleets in Divisions VIIIc and IXa are mainly composed of trawlers, fixed netters, longliners and purse seiners. A summary of the main characteristics of the vessels involved in demersal fisheries is given in Table 2.2.1.b). The duration of their trips is usually less than one day.

Trawl fleet

The trawl fleet in Divisions VIIIc and northern part of Division IXa (southern Galicia) is composed of bottom trawlers ("bakas") and pair bottom trawlers, catching demersal fish in the shelf area down to a depth of 500 m. The number of trawlers has decreased since the early 1980's.

Hake was the main target species of trawlers in the 70's. In recent years hake represents only about 6% of total weight landed but it is still the main species by value (about 23%). The most important species in weight is blue whiting (45%), which is the second in value (11%), followed by horse mackerel (18% in weight and 5% in value). Blue whiting is caught mainly by pair-trawlers.

The fishing effort evolution in Division VIIIc of inshore trawl fleets from some representative ports is presented in Table 2.2.2. Despite differences depending on the port, overall effort appears to have decreased since 1991.

A numerous fleet of bottom trawlers is present in the southern part of Division IXa (Gulf of Cadiz) (Table 2.2.1.c). These vessels differ from the trawlers of the northern part of Division IXa and VIIIc by their characteristics (they are smaller), by their fishing area (they sometimes fish in Northern African waters), and by the composition of the catches (not only hake, but crustacean and molluscs, such as octopus, among other species).

Fixed nets

In Division VIIIc and the northern part of Division IXa (southern Galicia), there are three kinds of fixed nets, depending on mesh size and height of panels: "betas" (60 mm mesh size), "volantas" (90 mm) and "rascos" (280 mm). The vessels using these gears are currently subject to a restricted entry system.

The fleet using "betas" is composed of 249 small boats that operate in shallow waters close to the coast and alternate their activity with other types of artisanal gears. Hake represents only 9% of the total landings and value of the catches.

Gillnetters with "volantas" (129 boats) are directed at hake on the shelf. Gillnetters using "rascos" (181 boats) have anglerfish as the main target species and fish on the shelf edge.

In the southern part of Division IXa (Gulf of Cadiz), 13 "volantas" vessels are directed at hake.

Longlines fleet

This fleet is composed of 687 boats and operates mainly in Division VIIIc, either on the shelf or on the shelf edge. It uses long-lines and/or other types of hook-lines. In summer, a significant part of this fleet fish for tuna (trolling boats). The most important species in weight landed by this fleets is mackerel (48%), but it represents only 8% of the total value. Hake is the second species in weight (18%), but the first in value (54%). Figures relating to tuna catches are not taken into account in this description.

Table 2.2.1. Description of the operative Spanish fleets in the different sea areas :
a) Sub-Areas VI-VII and Divisions VIIIa,b,d, for the period 1990-94.
b) Divisions VIIIc and Northern IXa (Galicia), for the period 1989-93.
c) Southern part of Division IXa (Gulf of Cadiz), for 1993.

a) Sub-Areas VI-VII and Divisions VIIIa,b,d

GEAR	Characteristics	1990	1991	1992	1993	1994	Mean (90-94)
Trawl	N. of vessels	230	213	190	174	180	*197*
	Mean tonnage (GRT)	226	228	220	218	244	*227*
	Mean power (HP)	744	747	669	729	732	*725*
	Mean length (m)	30	30	28	29	30	*29*
	Mean age (y)	22	23	24	22	23	*23*
Long-line	N. of vessels	197	208	187	181	167	*181*
	Mean tonnage (GRT)	162	154	160	162	169	*165*
	Mean power (HP)	597	588	600	613	627	*613*
	Mean length (m)				25	26	*30*
	Mean age (y)	18	19	19	18	19	*19*

b) Divisions VIIIc and IXa, for the period 1989-93.

GEAR	Characteristics	1989	1990	1991	1992	1993	Mean (89-93)
Trawl	N. of vessels	274	268	280	278	297	*279*
	Mean tonnage (GRT)						*141*
	Mean power (HP)						*423*
	Mean length (m)						*26*
	Mean age (y)						*25*
Gillnet	N. of vessels	574	561	530	562	569	*559*
	Mean tonnage (GRT)						*9*
	Mean power (HP)						*72*
	Mean length (m)						*9*
	Mean age (y)						*21*
Long-line	N. of vessels	696	691	694	678	678	*687*
	Mean tonnage (GRT)						*26*
	Mean power (HP)						*12*
	Mean length (m)						*13*
	Mean age (y)						*19*

c) Southern part of Division IXa (Gulf of Cadiz), for 1993.

GEAR	Characteristics	1993
Trawl	N. of vessels	273
	Mean tonnage (GRT)	25
	Mean power (HP)	216
	Mean length (m)	14
	Mean age (y)	23
Gillnet	N. of vessels	13
	Mean tonnage (GRT)	n/a
	Mean power (HP)	n/a
	Mean length (m)	n/a
	Mean age (y)	n/a

Table 2.2.2. Fishing effort evolution in some representative ports of the Spanish fleets operating in Sub-area VII, Bay of Biscay (Div. VIIIa,b,d) and Division VIIIc, as they are used in the VPAs of different southern demersal stocks. (Effort is expressed in number of fishing days per 100 HP).

1) Trawler Fleet ("Bakas") in Sub-area VII (Unit 4)

Year	Vigo	La Coruña	Cantabrico	Total
1982	75194	137883	16552	229629
1983	75233	107643	16411	199287
1984	76448	113535	10600	200583
1985	71241	115331	11553	198125
1986	*68747*	*95269*	*12620*	*176636*
1987	66616	104530	13552	184698
1988	65466	108856	13874	188196
1989	75853	104825	19707	200385
1990	80207	96299	11580	188086
1991	78218	85220	20845	184283
1992	63398	58516	23826	145740
1993	59879	50007	22125	132011
1994	56546	49880	18650	125076

2) Trawler Fleet ("Bous") in Divisions VIIIa,b,d (Unit 14)

Year	Pasajes
1980	163373
1981	90002
1982	73158
1983	63510
1984	30237
1985	41155
1986	*46719*
1987	50664
1988	42160
1989	47193
1990	50776
1991	47844
1992	56228
1993	55195
1994	42228

3) Trawler Fleet ("Bakas" & "Pairs") in Division VIIIc

Year	Aviles	Santander	La Coruña "Bakas"	"Pairs"	Total
1986	10845	24481	39810	*25630*	100766
1987	8309	18747	34680	29820	91556
1988	9047	20825	42180	12980	85032
1989	9063	22033	44440	15240	90776
1990	8497	17751	44430	18250	88928
1991	7681	20423	40440	30530	99074
1992		22556	38910	26670	
1993	7635	21370	44504	21349	94858
1994	9620	22772	39589	20732	92713

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2.2.3 Portuguese Fleets

The Portuguese fishery for demersal species in Division IXa involves trawl fleet and polyvalent fleet.

Trawl fleet

This fleet comprises two components, e.g., trawl fleet fishing for demersal fish and trawl fleet fishing for crustaceans.

The demersal fish fleet operates along the whole coast of Portugal and during the year. The total number of fish trawlers has remained stable over the last decade, being 105 the average number of boats operating between 1990-1993. Their engine power range from 88 to 1140 kw (mean value of 153 kw), being the mean LL (length-over-all) around 31 m and the mean age of the vessels 24 years. This fleet uses a minimum of 40 mm mesh size. The average fish catch composition of this fleet shows that in recent years horse-mackerel and hake are the most important species, representing 39.2% and 3.2% of the total catch in weight, respectively.

The Portuguese crustaceans trawl fleet, fishing mainly in the Southwest and South coast, in deep waters (200-750 m), started to operate in 1983 with 35 trawlers. In the period 1989-1993, the average number of operating crustaceans trawlers was 37. The average engine power of the crustaceans boats is 409 kw, ranging from 240 kw to 510 kw, being LL=24 m. The crustaceans trawlers are smaller than the demersal trawlers and generally older. Part of the fleet originates from sardine purse seiners that were transformed to trawlers. This fleet operates with a 55 mm mesh size. The most important fish species in weight landed are anglerfish and hake, their average (1989-1993) catch composition being 13.4% and 10.4%, respectively.

Global effort (fish + crustacean trawlers) indicate that effort has been decreasing during the period 1988-1994, the 1994 estimate being 60% of the maximum effort observed in 1990.

Polyvalent fleet

This fleet has two components, one operating in coastal waters and the other in offshore waters. Most of these vessels are licensed to use several types of gears during the year. The smaller vessels are not required to complete logbooks and it is difficult to identify the catch taken by each gear. In the South coast some boats fishing with gillnets operate in deep waters (up to 750 m). Since the 1980's longlines have become less common in Portuguese waters but they are still being used, mainly in three fishing harbours.

The total number of boats of the offshore component of this fleet has decreased from 997 units in 1990 to 941 in 1993 (data for 1994 is not yet available). The average values of their main characteristics are: GRT=26.1, LL=26 m and 114.3 Kw of engine power.

In the case of the inshore fleet, the number of boats has sharply decreased from 12000 units in 1990 to around 9000 in 1993, with an average GRT of 1.6 and LL of 6.7 m. Only 60% of these small boats have engine power, being their average 11.2 Kw.

The landings from polyvalent fleet are composed of a variety of species, being hake, anglerfish, pouting and octopus the most important species in economical terms providing, 11% (hake) and 5% (the others) of the total landings income while megrims only contribute with 0.1%. Nevertheless, the proportion of these species in the total landings in weight is low.

2.3 Appropriateness of Sock Units for Assessment Purposes

In principle, the definition of a 'biological' stock appropriate for assessment purposes is that it is that part of a species' population for which parameters describing the vital processes (natural mortality, growth and reproduction, recruitment, migrations, etc.) are recognised to be relatively homogeneous. However, when the stock is viewed as a management unit, some compromise often has to be found between a strict biological definition and operational needs. On the one hand, the 'management' stock should also respond in an homogeneous manner to exploitation and to regulatory measures. On the other hand, managers may want to deal with identifiable fleets or social groups to negotiate or implement decisions, which often leads to subdividing biological stocks.

This section essentially deals with the possible inter-relationships between populations in the English Channel, Celtic Sea and Irish Sea which, as far as this Group is concerned, pose the most questions. Information describing the identification and distribution of these stocks has been taken from a review of the existing literature and analysis of historical data sets and other previously unpublished material (Pawson, 1995; see References for full list). The Group did not have equivalent material to discuss the separation between stocks in the Bay of Biscay and those around the Iberian Peninsula.

COD

Cod are distributed throughout sub-area VII, but their abundance is reduced to the south and west and they are relatively scarce in the Bay of Biscay (Wheeler, 1978).

The relationships between spawning areas, nursery areas and the adult stocks in sub-area VII to which young cod recruit are not well understood. Within the

Channel, cod spawn predominantly inshore along the south coast of England and off Dieppe and in the Baie de Seine, though cod eggs are seldom observed in the western Channel (Brander, 1994). There are also cod spawning areas off northern Cornwall and south-eastern Ireland. Young cod become demersal at lengths above 2 cm and, by late summer, they are concentrated in coastal waters (Macer and Easey, 1988). Although 0-group nursery areas in Sub-area VII have not been identified, cod usually recruit to the fishery during their second year, and 1-groups are abundant on the French coast of the eastern Channel and around Land's End (Lefranc, 1970).

Analysis of 2840 returns of cod tagged in the southern North Sea indicated that 0.2% were recaptured in the western Channel, 2% in the eastern Channel, and the remainder in the North Sea (MAFF, unpub.). Immature cod, 30-49 cm in length, tagged in the eastern Channel, generally moved east into the southern North Sea (40% of returns), and only 5% of returns were from the western Channel, principally during the summer and autumn (Bedford, 1966). These fish showed less tendency to move west than similar fish tagged in the western Channel did to move east.

Mature cod tagged in the Celtic Sea and Bristol Channel were recaptured all along the west coast of Britain, though others subsequently returned to the release area, and it is suggested that these cod are part of a group which regularly returns to the spawning area off north Cornwall (MAFF, unpub.). There is no evidence to indicate that these adult cod or their progeny ever move into the western Channel. It therefore appears that cod in the western Channel may have more affinity with those in the eastern Channel than with those in the Celtic Sea.

The North Sea cod population is genetically homogeneous, but there is some evidence of genetic separation of the cod which spawn in the Irish Sea (Child, 1988). Further evidence that at least one stock boundary exists in the Channel comes from recruitment series, which show that 1985 was the last year class of well-above average abundance in the North Sea and eastern Channel, whereas the 1986 year class was very strong on the west coast. The dominant age of cod landings from east and west Channel are 2 and 3 respectively, which may indicate that there are two management stocks in VIId and VIIe.

Though the growth of cod in the Irish Sea and in the Celtic Sea is different, there is some evidence of interchange of the cod populations which spawn off Trevose head and in the Irish Sea, and recruitment patterns are similar along the west coast of Britain. It appears, however, that the western Channel cod are isolated from stocks to the east and west.

WHITING

Whiting are abundant in the North, Irish and Celtic Seas, central and northern Bay of Biscay, and in the English Channel (Wheeler, 1978). Whiting larvae are present at inshore sites throughout the Channel, being most abundant around Beachy Head in the east and Start Point in the west, the areas where eggs are most concentrated in February, March and April (Katerinas, 1986; Riley *et al.*, 1986). Whiting post-larvae adopt a demersal existence by September, and 0-groups occur in shallow inshore sites throughout the English Channel coast, along the French coast of the eastern Channel, and in other estuarine regions, such as the Bristol Channel. One-group and older whiting are regularly caught at sites frequented by adult fish (MAFF, unpub.).

Whiting have been tagged in the Channel on a number of occasions (MAFF, unpub.). Nearly 4000 trawl-caught fish were released off Start Point during August 1958 and 1960, and there was little indication of any migratory movement of the 12-13% returned. Out of 332 returns of whiting tagged during autumn in the southern North Sea in the period 1950-1988, many fish moved into the eastern Channel, but only 3 returns were recorded from the western Channel.

Studies of the parasites of whiting indicated that fish from the western Channel and southern North Sea were predominantly infected by *Myxidium* sp and *Lernaeocera branchialis* (Kabata, 1963; Pilcher *et al.*, 1989) whereas other data suggest that *Diclidophora* infection rates may be higher in the Plymouth area than in the southern North Sea (Llewellyn, 1956).

Unfortunately, there are very few data which allow relationships between whiting in sea areas along the west coast to be described. Tagging data and the prevalence of parasites indicate that there is a stronger relationship between whiting in the southern North Sea and the eastern Channel, than between whiting in the east and west Channel.
As with cod, whiting in the Celtic Sea appear to grow faster than whiting in the Irish Sea.

HAKE

Hake are most abundant on the continental shelf from Ireland south to Gibraltar (Quero, 1984). Spawning in the Bay of Biscay takes place from December to July, but mainly in the first quarter of the year with a probable peak in February (Martin 1991). A similar pattern is observed off the Portuguese coast (Dinis, 1986, pers. com) and off the Spanish northern and north-western coast, from December to April with a marked peak in February-March (Alcazar 1983). In areas to the south and west of Ireland the period March-July appear to be the hake spawning season

(Hickling, 1930; Hickling and Rutenberge, 1936; Fariña y Fernandez., 1986).

Two stocks have been recognised for assessment and management purposes since 1978, when the Hake Working Group decided to divide the European hake into a northern area (Divisions IVa, VIa, Sub-area VII and Divisions VIIIa,b) and a southern area (Divisions VIIIc and IXa) (Anon. 1978). This separation was based on the state of knowledge at that time and, from a management point of view, that there was an advantage in distinguishing the EEC sea area from the rest (Spain and Portugal did not belong to the EEC at that time) (Gonzalez-Garces y Pereiro, 1994).

In the north, hake larvae appear to be most abundant along the shelf edge south from Ireland through the Bay of Biscay, and the centres of larval distribution are offshore (Anon., 1980). Young hake descend to the seabed from May onwards and congregate initially at depths in excess of 200 m (Pineiro and Hunt, 1989). Two major nurseries are recognised: one in the Bay of Biscay and one off southern Ireland. When three years old, the hake begin to move into shallower regions of the Celtic Sea and the Bay of Biscay, but as they approach maturity they disperse offshore. Tagging of hake has been attempted, but with little success.

In the south, the major nursery areas are found at depths of 150–300m off Northwest Spain and off north and central Portugal. Immature fish are found on the shelf, whereas mature hake, especially females, tend to concentrate on the slope down to 700 m (EC, 1994).

The main uncertainty relates to the integrity of the 'northern stock', and particularly to the status of the hake populations present in the northern North Sea and northwest of Scotland. There is a lack of information to clarify whether hake in these areas come from local recruitment.

PLAICE

Although there have been numerous studies describing the general structure, fecundity and biochemical characteristics of plaice populations, tagging programmes and ichthyoplankton surveys have provided most of the information upon which management of the plaice fishery has been based.

Plaice spawn from December to March off Trevose Head, in the central western Channel off Start Point and Portland Bill, and in the central eastern Channel from Dungeness to the Isle of Wight (Houghton and Harding, 1976). Spawning in the Channel occurs within an easterly-moving current system, and information on developmental rates of eggs and larvae suggests that metamorphosing plaice immigrating into the Easterscheldt and western Waddensea were spawned in the eastern Channel (Rijnsdorp and van Stralen, 1985). However, those spawned in the western Channel, where currents are rather weaker, probably recruit mainly to nurseries in sandy bays on the Channel coast.

An analysis of juvenile plaice tagging in the eastern Channel indicates that nursery grounds there supplied only 0.3% of recruits to the North Sea, but 34% of the recruits in the western Channel (Anon., 1992). The North Sea is also an important source of plaice migrating into the western Channel, supplying 53% of the recruits.

Many adult plaice, tagged at spawning time in the eastern and western Channel in 1971 and 1972, migrated rapidly to the North Sea (Houghton and Harding, 1976). An analysis combining SSB estimates with estimates of fishing effort at the recapture sites suggested that, of the plaice spawning in the Channel, 20% spent the summer in the western Channel, 24% in the eastern Channel, and approximately 56% migrated to the North Sea. However, plaice tagged in the Channel during the summer were not recaptured outside the Channel, and appeared to be members of two groups which returned to specific (east or west Channel) spawning areas each winter.

Plaice tagged in the Channel, in all seasons of the year, were rarely recaptured from the Irish Sea (Houghton, 1976; de Clerck, 1977). Similarly, only a small proportion of the fish recaptured from nearly 17 thousand plaice tagged in the Irish Sea had been returned from the western Channel (Macer, 1972).

It is possible that three plaice stocks could be recognised in the Channel: the resident eastern Channel stock; the western Channel stock; and a migratory eastern Channel/southern North Sea stock. However, their distributions frequently overlap for considerable periods and thus it would be difficult to manage them independently. The movements of plaice between the Channel, the Celtic Sea and the Irish Sea are unlikely to be significant for these areas to be amalgamated for purposes of fishery management.

SOLE

Sole are distributed in north-east Atlantic shelf waters from southern Norway and the Shetlands south to Mauritania (Wheeler, 1978). Spawning occurs from February until June in the Channel, in deep water off Trevose Head in the Celtic Sea and offshore in northern Biscay (Anon., 1986). In the eastern Channel, the highest egg concentrations are found in the Dover Strait, the Baie de Somme, Baie de Seine and around the Isle of Wight (Riley *et al.*, 1986). Sole eggs are generally less abundant in the western Channel, where the highest densities of eggs were found in the Baie de St Michel, Start Bay and in mid-Channel (Anon., 1991).

There are sole nurseries in estuaries, tidal inlets and shallow, sandy bays on the English and French Channel coasts (Mesnil, 1983; Millner and Whiting, 1990). The overall density of juvenile sole is highest in the eastern Channel, although sole may be abundant in small western Channel estuaries such as the Tamar (Coggan and Dando, 1988). Marking and sampling studies suggest that 0-, 1- and 2-group sole move offshore in the winter and migrate inshore again in the spring (Dorel *et al.*, 1991). However, some 3-year olds emigrated from the release areas in the Baie de St Michel and the Baie de Seine to the English side of the western Channel, and the seasonal distribution of returns suggested that this movement was permanent (Anon., 1989). In general, recaptures from eastern Channel releases suggested that there was a permanent emigration of around 10% of juvenile sole to the southern North Sea and up to 30% to the western Channel.

Once fully mature, the movements of sole appear to be relatively restricted. The seasonal distribution of tag returns and, to some extent, shifts in LPUE in the sole fishery, suggest that adult sole make short seasonal migrations between deeper offshore areas and the shallower spawning grounds, with a return movement in the autumn (Anon., 1989). It is unlikely that a significant proportion of adult sole migrate from the Channel to adjacent seas, because sole appear to continue to use the spawning ground to which they first recruit (Anon., 1991).

The fecundity of sole is higher for a given body weight in the eastern Channel and North Sea than in the western Channel, the eastern Celtic Sea or the northern Bay of Biscay (Anon., 1991).

It is concluded that adult sole in the eastern Channel are largely isolated from those in other regions, though a proportion of their progeny may emigrate to the southern North Sea and the western Channel. Adult sole in the western Channel may recruit from local nurseries on both the French and English coasts and from those in the eastern Channel, but there is no evidence for significant emigration of juvenile sole from the western Channel. The limited migration of adult sole, coupled with the localised spawning areas, suggest that fish spawning in the western Channel are largely isolated from those in northern Biscay, the eastern Celtic Sea and the eastern Channel.

ANGLERFISH

The anglerfish, *L. piscatorius*, is found in north-eastern Atlantic waters from Iceland and Norway south to central West Africa, and is usually caught at depths of 20-150 m, although catches have been recorded from 550 m (Gaertner, 1985). The black anglerfish, *L. budegassa*, is distributed from western Scotland south to North Africa, tends to occur at depths greater than 100 m, and is rarely caught in the Channel (Quero, 1984). The abundance of *L. pisc.* is greatest in the deeper water of the western Channel and Celtic Sea throughout the year.

The majority of anglerfish (*L. piscatorius*)are thought to spawn in deep water to the west of Ireland, in the Celtic Sea and in the Bay of Biscay (Quero, 1984). Larvae have frequently been observed in ichthyoplankton samples from the continental shelf edge to the west of Ireland and in the Celtic Sea (Arbault and Lacroix-Boutin, 1968), but there are few records of larvae in the Channel.

Juvenile anglerfish have been caught during groundfish surveys in deep water to the west of the British Isles and in the Bay of Biscay (Quero, 1984), and during beam-trawl surveys off south Devon at depths to 70 m and in beach-seine surveys in the Bristol Channel (MAFF, unpub.).

Little is known about the migrations of anglerfish, but the quarterly distribution of LPUE data suggests that the centres of the species' distribution in the deeper parts of the Celtic Sea do not change appreciably during the course of the year (Anon., 1993).

The available data do not elucidate the stock structure of anglerfish, but the extended duration of the pelagic larval phase (Karlovac and Karlovac, 1968) suggests that there may be considerable interchange of larvae from spawning areas in the Celtic Sea and northern Bay of Biscay. The subsequent juvenile and adult migrations appear to be relatively restricted.

CONCLUSIONS

It is too early for conclusions to be made about the need to redefine the assessment areas on the basis of the stock identity information provided in this preliminary report, and there is clearly a need for species co-ordinators to contribute up-to-date and additional material in time for the Working Group's next meeting. This may point to the need for further biological work using stock identification methods on some species, and indicate the period of time which might elapse before adequate data are available.

However ACFM decided to use this information, it needs to be pointed out that when 'stocks' are combined it may be difficult to assess the impact of different regulations - both technical measures and direct controls on fishing mortality - applied to the various fishery units exploiting the original stocks. Also, there will need to be a decision as to which assessment working group, and therefore which stock co-ordinator, will be responsible for the 'new' stock.

3. WESTERN CHANNEL COD (DIVISION VIIE)

3.1 Landings

Landings as officially reported to ICES are given in Table 2.1.1, and nominal catches used by the Working Group are given in Table 3.1.1. France and the UK account for virtually all of the landings. In recent years, total landings increased to above 2700 t in 1988, when they were boosted by the abundant 1986 year class, but subsequently they have declined to below 600 t in 1993 and 1994. For years before 1987 there are uncertainties regarding the reliability of landings estimates for French coastal vessels. No data were available on discarding.

3.1.1 Age and length compositions

Quarterly and annual length compositions are available in recent years for UK (England and Wales), and the annual length composition for landings in 1994 is given in Table 3.1.2.

Age compositions for UK (England and Wales) for the period 1988 to 1994 are given in Table 3.1.3, together with data for mean weight at age. No length or age compositions were available for other countries. It is considered that English landings may not be representative of landings by other countries.

In view of the inadequate set of age composition data, no assessment was carried out.

3.2 Western Channel Whiting (Division VIIe)

3.2.1 Landings

Landings as officially reported to ICES are given in Table 2.1.2, and nominal catches used by the Working Group are given in Table 3.2.1. As with cod, France and the UK account for most of the landings. Total landings in recent years increased to 2600 t in 1988, , but subsequently have returned to around 1800 t in 1993 and 1994. No data were available on discarding.

3.2.2 Age and length compositions

Quarterly and annual length compositions are available in recent years for UK (England and Wales), and the annual length composition for landings in 1994 is given in Table 3.2.2.

No age compositions were available.

The available data were not adequate for any assessment to be attempted.

Table 3.1.1 Western Channel Cod. Nominal catches (t) of cod in Division VIIe as used by the Working Group.

Country	1987	1988	1989	1990	1991	1992[1]	1993	1994
Belgium	10	12	19	6	6	2	5	1
Denmark	-	-	-	5	-	-	1	2[1]
France	1,119	1,899	1,453	654	341	331	286	249
UK (England and Wales)	497	832	724	605	402	364	274	311
UK (Scotland)	-	-	2	4	-	-	1	-
Total	1,626	2,743	2,198	1,274	749	697	528	563

[1]Preliminary.

Table 3.1.2 WESTERN ENGLISH CHANNEL COD.
Annual length distributions by fleet 1994.

UK (England & Wales)

Length (cm)	Beam trawl	All gears (exc beam/dredge)
33		904
34		3097
35	451	14657
36	641	14067
37	658	11295
38	863	11589
39	926	12078
40	1408	9733
41	1155	7079
42	1633	6178
43	1760	4741
44	2019	2664
45	2639	3135
46	1743	2837
47	1877	2207
48	1499	2165
49	1289	2602
50	1509	1071
51	749	895
52	904	850
53	537	594
54	273	640
55	163	814
56	167	299
57	0	21
58	45	434
59	22	196
60	0	221
61	0	459
62	16	813
63	0	418
64	0	458
65	0	1043
66	63	1386
67	126	1154
68	85	814
69	54	622
70	0	1653
71	125	1312
72	39	2418
73	22	1133
74	151	937
75	159	1781
76	151	1022
77	54	1272
78	197	792
79	0	621
80	144	587
81	45	801
82	231	296
83	37	544
84	126	752
85	166	899
86	67	627
87	0	1160
88	64	336
89	39	1231
90	22	598
91	96	697
92	33	235
93	33	478
94	33	259
95	16	102
96	71	416
97	16	0
98	0	359
99	79	55
100	16	122
101	0	49
102	0	122
103	0	266
104	0	122
105	88	0
106	0	0
107	16	0
108	33	0
109		128
Total	27643	148412

Table 3.1.3

Cod in the Western English Channel (Division VIIe).
English landings.

a) Age Compositions (thousands).

Age	1988	1989	1990	1991	1992	1993	1994
1	38.8	4.1	17.3	131.0	66.7	4.7	135.6
2	488.7	75.1	14.3	16.3	132.0	67.2	10.5
3	16.9	96.5	28.5	8.6	9.0	23.7	23.6
4	8.0	18.3	29.5	12.8	2.9	1.6	9.0
5	4.0	4.1	28.5	12.2	2.1	0.9	1.2
6		1.0		4.9	4.2	0.7	0.5
7+				0.2	2.4	2.1	1.2
Total	556.4	199.1	118.1	186.0	219.3	100.9	181.6
Tonnes landed	832	724	605	402	364	274	309

b) Mean weight at age (kg).

Age	1988	1989	1990	1991	1992	1993	1994
1	0.85	0.89	0.75	0.79	0.70	0.93	0.73
2	1.42	1.69	2.83	2.01	1.38	1.79	1.79
3	2.41	4.41	4.98	4.40	3.92	4.46	4.29
4	3.13	7.02	6.4	6.47	6.38	5.41	6.83
5	10.09	7.97	7.81	7.89	9.15	8.51	8.14
6		9.47		9.35	9.84	8.16	10.17
7+				12.59	8.87	10.55	11.38
Sum of products	832.74	726.32	607.13	401.73	364.46	274.52	309.01

Table 3.2.1 Western Channel Whiting. Nominal catches (t) of whiting in Division VIIe as used by the Working Group.

Country	1987	1988	1989	1990	1991	1992[1]	1993	1994
Belgium	2	4	3	4	2	1	2	2
France	1,510	1,485	915	479	667	543	625	772
UK (England and Wales)	746	1,167	911	1,352	1,431	931	1,240	1,028
UK (Scotland)	-	-	5	41	21	-	5	-
Total	2,258	2,656	1,834	1,876	2,121	1,475	1,769	1,802

[1]Preliminary.

Table 3.2.2 WESTERN CHANNEL WHITING.
Annual length distributions by fleet 1994.

UK (England & Wales)

Length (cm)*	Beam trawl	All gears (exc beam/dredge)	
24		6214	
25	956	1737	
26	239	2001	
27	562	30000	
28	2090	108658	
29	5266	154828	
30	10687	230077	
31	16936	239988	
32	13661	275328	
33	15910	274952	
34	16861	271784	
35	13444	196602	
36	14729	202971	
37	14703	136507	
38	10898	104973	
39	9132	92492	
40	7942	64637	
41	8378	47747	
42	5224	37109	
43	5006	30000	
44	3540	21396	
45	2665	19851	
46	1456	14866	
47	948	10917	
48	1284	9732	
49	1534	7413	
50	564	9645	
51	484	6224	
52	299	3256	
53	219	1767	
54	177	1520	
55	0	1204	
56	0	407	
57	81	407	
58	41	420	
59	69	107	
60	0	0	
61	0	1068	
62	41	136	
Total	186026	2618941	0

* Lower limit for UK

3.3 Sole In The Western Channel (Division VIIe)

3.3.1 Landings

National landings data reported to ICES and as used by the Working Group are given in Table 3.3.1. Total international landings in 1994 were 670 t, 33% less than the TAC of 1000 t, and 25% less than the landings of 900 t predicted last year based on status quo F. Adjustments to national landings in 1993 resulted in a 2t reduction in total international landings to 762 t. Landings reached a peak level above 1,400 t in 1982 and 1983, boosted initially by high recruitment in the late 1970s, followed by an increase in exploitation. Landings have declined since 1989, following the recruitment of 3 year classes (1986-88) of below-average abundance.

As in previous years, UK(England and Wales) vessels were subject to monthly landings quotas, and all national fisheries for this stock remained open throughout 1994.

3.3.2 Effort and CPUE data

Effort and CPUE data were available for UK beam trawlers and a UK autumn beam-trawl survey. 'Total VIIe', 'inshore' and 'offshore' CPUE and effort series are given in Table 3.3.2.

UK beam-trawl effort increased in 1994 by 15% but is still 19% below the average level observed for the period 1983-93. Effective effort by all UK gears combined (corrected by a GRT/fishing power relationship) increased by 20% from 1993.

The beam-trawl CPUE series for the whole of Division VIIe shows a decrease in 1994 of around 5%. This is caused mainly by a reduction in the CPUE of beam trawlers fishing inshore (down by over 11%), whereas offshore beam-trawl CPUE has been stable in the last three years. The autumn beam-trawl survey CPUE has been decreasing since 1992. The decline was evident both inshore and offshore.

All available CPUE series continue to indicate that absolute levels of stock remain low relative to those observed before the mid-1980s.

3.3.3 Age and length compositions and weight at age

Quarterly age compositions for 1994 were available from the UK only, they represent 81% of the total international landings. Quarterly catch data only, were available from France and Belgium.

The UK quarterly age compositions were raised to the total international landings (including the Channel Islands). The SOP discrepancy for the total international age composition was less than 0.1%.

Annual catch numbers at age are given in Table 3.3.3.

Using the same procedure as in previous years, total international catch and stock weights at age for 1994 were calculated as the weighted mean of the annual weight at age data (weighted by catch numbers), and smoothed using a quadratic fit :

$$Wt = 0.0238 + 0.0677*Age - 0.0016 * Age^2$$

where catch weights at age are mid-year values (age = 1.5, 2.5 etc), and stock weights at age are 1 January values (age = 1.0, 2.0 etc). Catch weights at age have been scaled to give a SOP of 100%, and the same scaling has been applied to stock weights at age. Catch and stock weights at age are given in Tables 3.3.4 and 3.3.5

Annual length compositions for 1994 are given, by fleet, in Table 3.3.6.

3.3.4 Natural Mortality and maturity at age.

Natural mortality was assumed constant over ages and years at 0.1, and maturity was assumed to be knife-edged at age 3, as in previous assessments.

3.3.5 Estimation of fishing mortality

General approaches and methods are described in Section 1.5.1

The age range used in the assessment was 1-10+. A preliminary inspection of the quality of international catch-at-age data was carried out using separable VPA, with a reference age of 4, terminal F = 0.4 and terminal S = 1.0 (results in ICES stock files). The log-catch ratios for the fully recruited ages (3 and older) did not show any large residuals.

VPA tuning data were available from UK vessels fishing 'inshore' and 'offshore' (1973-94), and for the UK autumn beam-trawl survey (1984-94) (Table 3.3.7). The UK beam-trawl survey units are now expressed as numbers per km towed. Tuning fleet catch numbers-at-age are derived by applying one ALK to each length composition. As last year, tuning was carried out using data from 1973 onwards with tricubic down-weighting over 20 years.

The tuning data were examined for trends in catchability by carrying out L/S tuning runs without shrinkage, using data for each fleet individually. As in previous years, age 9 fishing mortalities were set to 0.9 times the mean of the three previous ages (mean F). Although examination of the residuals and inspection of regression slopes (in ICES stock files) revealed

some negative trends in catchability in a few ages of one fleet, these did not justify rejection of that data set. In previous XSA assessments of this stock, ages 1, 2 and 3 have been treated as having catchability dependent on population abundance, with the catchability constant with respect to age after age 6. Preliminary runs with q held constant with age above age 7 and dependent on year-class strength at all younger ages, revealed regression slopes which differed significantly from 1.0 for groups of ages in the inshore fleet and survey tuning data.

The t values were significant for the inshore fleet at ages 4 and 5, at the 5% level, and age 6 at 10%. The standard errors of the regressions at these ages were considerably lower than when catchability was independent of population abundance.

All "recruit" ages in the survey have slopes that are consistently less than 1.0, with relatively high t values and low standard errors. The t values at ages 3 and 4 were significant at the 5% level, age 6 at the 10%.

The regression slopes from the offshore fleet differ from 1.0 only at age 3 (10%). At ages 4, 5 and 6 the slopes are close to 1.0 with low t values. Applying the catchability dependent on population size model to this fleet has no effect on the standard errors at these ages.

The application of a model which allows catchability to vary with year-class strength for the majority of ages in the assessment, is consistent with the changes in effort in this fishery. Variation in effort occurs as the more mobile vessels in the fleets move from area to area dependent on prevailing catch rates.

The overall effect of using this combination of parameter selections within XSA was to reduce the standard errors of the estimated regression slopes and constant catchability values for the majority of ages, for all fleets (for tuning diagnostic output from comparative runs see ICES files). The log catchability residuals from the final XSA fit are plotted for each fleet in Figures 3.3.1a and 3.3.1b. The residuals have no trends and, apart from the inshore fleet at age 2, show that the application of the catchability dependent on population size model to ages 1 - 6 produces close agreement between the VPA and tuning data.

The low standard errors apparent in the XSA tuning diagnostics indicate that F shrinkage will not influence terminal population estimates during tuning, unless a s.e of less than 0.3 (30% c.v.) is used for the specified weight. Treatment of the first 6 ages as catchability dependent on population size reduces the influence of F shrinkage, but introduces population shrinkage at these ages. At age 1, the population mean contributes 48% of the overall weight, at age 2, 28%, and for age ages 3 - 6, less than 20% (Table 3.3.8). The fleet tuning data contribute the greatest proportion of information used in the estimation of the terminal values, at all ages.

Retrospective analyses comparing the terminal estimates of Fbar(3-7), SSB and recruitment at age 1 were used to compare the results from XSA runs using last year's parameter selections (Figure 3.3.2) and the new values (Figure 3.3.3). In addition to the apparent improvement in the fit of the XSA model to the data sets (lower s.e's), there is a marked reduction in the between-year variability in the estimated Fbar. The over-estimation bias in the estimated recruitment is reduced but still present. The variation in the estimated values of SSB and Fbar in the early years of the assessment occurs over the time period for which there is no tuning data. It results from noise in the estimated values of F at the older ages in the initial tuning years. It increases when the weight given to F shrinkage is reduced, but does not affect the perception of the stock's historical trends.

The final VPA run was made with ages 1 to 6 treated as recruits and q independent of age above age 7. Although this analysis indicates that shrinkage has no influence on the estimated terminal populations, some shrinkage is required in order to estimate the terminal populations of cohorts outside of the tuning range. A large shrinkage s.e. of 1.0 was therefore used. The diagnostics from this run are given in Table 3.3.8.

3.3.6 VPA results

Estimates of fishing mortalities and stock numbers from the final VPA are given in Tables 3.3.9 and 3.3.10 and are summarised in Table 3.3.11 and Figures 3.3.4A and B.

F increased sharply from 1976 to the late 1980's and has subsequently decreased in line with landings. F94 is at a level equivalent to that estimated for 1992 and 1991.

SSB increased to a peak value of 5,900 t in 1980 and then declined steadily until 1989, since when it has been relatively stable. The estimated 1994 SSB, at 3000 tonnes, is 17% below the historical average.

3.3.7 Yield-per-recruit and catch predictions

Input data for yield-per-recruit calculations and catch forecasts are given in Table 3.3.12. The F-at-age vector was the mean for the period 1992-94 rescaled to the 1994 level (F3-7 = 0.239). Weights at age in the catch and the stock were averaged for the last three data years. SSBs are calculated at 1st January. GM recruitment at age 1 was assumed for the 1994 and subsequent year classes. All other stock numbers were taken from the VPA. The XSA results show that the 1991 year class is largely determined by the UK beam-trawl and the UK inshore fleets and the estimate was

accepted. The 1992 year class is estimated to be 43% below average but close to the modal recruitment for this stock. As the estimate is largely determined by survey data, with a small contribution from population shrinkage, it was accepted. The UK survey (52%) and shrinkage to the population mean (48%) contributed equally to the XSA estimate of the 1993 year class. It is slightly lower than GM recruitment (4.1 millions). The estimate was accepted.

The results for yield per recruit and SSB per recruit, conditional on the recent exploitation pattern, are given in Table 3.3.13 and Figure 3.3.4c. Fmax is determined as 0.29, which is 21% above the 1994 level of F (0.24). Assuming *status quo* F, the current exploitation pattern, and GM recruitment, long-term yield and SSB are estimated to be 800 t and 3,700 t respectively, The stock-recruitment plot is shown in Figure 3.3.5. Fhigh is estimated to be 0.37, Fmed 0.25, and Flow 0.17. F94 is between Fmed and Flow. There is a clear indication that recruitment is reduced at low SSB levels.

Table 3.3.14 and Figure 3.3.4d give the management options assuming *status quo* F in 1995. The predictions give landings in 1995 of 663 t and an SSB of 3000 t, similar to the level in 1994. For continued fishing at the same level in 1996, landings of 680 t and an SSB of 3075 t are predicted with SSB increasing slightly to 3200 t in 1997.

The detailed output by age group from the status quo forecasts for 1995 to 1997 are given in Table 3.3.15.

Table 3.3.16 shows the expected percentage contribution of recent year classes to the catch in 1996 and to spawning stock biomass in 1997. GM recruitment for the 1994 and 1995 makes relatively small contributions to both (5 and 20% respectively).

3.3.8 Comments on the assessment

Several estimates have been revised compared to those obtained last year, as a consequence of the addition of a new data year and changes to the parameter selections within XSA. Retrospective analysis has indicated that the modified XSA approach reduces the systematic tendency to overestimate fishing mortality and recruitment in the last data year.

Mean F on ages 3-7 is estimated to have been 0.24 in 1994 and 0.31 in 1993 9% lower than estimated in last year's assessment (when $F_{93} = 0.34$). Mean F over the period 1990 to 1993 is now estimated to have been 11% lower than estimated last year.

The 1989 year class was estimated in 1991 to be twice average strength, and it was anticipated that when fully recruited this year class would have enhanced the SSB if exploitation did not increase. However, the size of this year class has been revised downwards in the last three assessments and it is now estimated to be 44% above average. Even at the relatively low level of F estimated in recent years, the anticipated enhancement of SSB has not taken place.

Although some doubts remain about the accuracy of the landings data for sole from Division VIIe, biological sampling data are good. Tuning data from a beam trawl survey provide fishery-independent estimates for cross-validation of the commercial data series, and contribute to the population estimates at all ages.

3.3.9 Management considerations

SSB in 1995 (3000t) is estimated to be below average, but above the levels observed during 1969-74 and 1989-92.

There is evidence of reduced recruitment at low SSB levels.

Following the strong 1989 year class all recruitments are estimated to have been below average strength.

Table 3.3.1 Division VIIe SOLE. Nominal landings (tonnes), 1972-1993 used by the Working Group.

Year	Belgium	France	UK (Engl. & Wales)	Other	Total Reported	Unreported[2]	Total as used by WG
1972	6	230[1]	201	-	437	-	437
1973	2	263[1]	194	-	459	-	459
1974	6	237	181	-	424	3	427
1975	3	271	217	-	491	-	491
1976	4	352	260-	-	616	-	616
1977	3	331	271	-	606	-	606
1978	4	384	453	20	861	-	861
1979	1	515	665	-	1,181	-	1,181
1980	45	447	764	13	1,269	-	1,269
1981	16	415	788	1	1,220	-5	1,215
1982	98	321	1,028	-	1,447	-1	1,446
1983	47	405	1,043	3	1,498	-	1,498
1984	48	421	901	-	1,370	-	1,370
1985	58	130	911	-	1,099	310	1,409
1986	62	467	840	127	1,496	-128	1,368
1987	48	432	632	-	1,112	47	1,159
1988	67	98	784	-	949	401	1,350
1989	69	112[3]	611	7	799	362	1,161
1990	41	81[3]	634	1	757	325	1,082
1991	35	111[2]	480	1	627	104	731
1992	41	122[2]	456	1	620	149	769
1993	59	223	480	-	747	-	762
1994[3]	33	91	546	-	670	-	670

[1]Estimated from Division VIId,e total by the Working Group.
[2]Estimated by the Working Group.
[3]Provisional

Table 3.3.2 Division VIIe SOLE. CPUE and effective effort indices.

Year	CPUE (kgs/hr)			UK autumn beam trawl survey (kgs/10 km)
	UK > 40' beam trawl			
	Total VIIe	Inshore	Offshore	
	Whole Year	Whole Year		
1972	16.27	16.27	-	-
1973	9.82	9.96	-	-
1974	9.98	10.65	-	-
1975	8.8	10.98	-	-
1976	12.45	15.1	-	-
1977	11.34	12.56	-	-
1978	11.97	13.4	-	-
1979	12.52	14.06	-	-
1980	10.41	11.65	9.44	-
1981	10.16	10.98	9.53	-
1982	10.86	12.48	9.21	-
1983	9.01	10.57	7.57	-
1984	9.19	9.23	9.17	-
1985	8.64	9.66	7.7	10.3
1986	9.74	8.81	10.3	13.0
1987	7.58	7.33	7.72	9.6
1988	7.5	7.48	7.51	7.4
1989	4.6	4.75	4.51	6.9
1990	5.61	5.39	5.59	4.4
1991	5.56	6.14	4.94	7.3
1992	6.18	6.19	6.08	7.8
1993	6.66	7.37	6.07	5.0
1994[1]	6.32	6.54	6.12	4.1

Year	Effective effort ('000 hrs)					
	UK > 40' beam trawl[2]			UK - all gears[3]		
	Inshore	Offshore	Total VIIe	Inshore	Offshore	Total VIIe
	Whole Year		Whole year			
1972	6.2	-	6.2	12.4	-	12.4
1973	10.2	0.2	10.4	15.8	5.6	21.4
1974	9.4	2.5	11.9	12.6	6.7	19.3
1975	7.2	4.0	11.2	12.8	13.9	26.7
1976	3.4	3.5	6.9	12.6	7.4	20.0
1977	4.9	6.3	11.2	14.0	9.9	23.9
1978	10.2	10.6	20.8	22.3	14.5	36.8
1979	21.9	15.5	37.4	31.2	20.4	51.6
1980	37.7	22.0	59.7	42.4	28.2	70.6
1981	37.3	25.8	63.1	46.4	28.8	75.2
1982	41.8	31.5	73.3	51.7	39.8	91.5
1983	32.0	43.9	75.9	51.1	66.4	117.5
1984	23.7	41.9	65.6	47.0	48.3	95.3
1985	31.6	37.8	69.4	54.9	47.3	102.2
1986	26.3	34.6	60.9	53.5	34.7	88.2
1987	23.6	45.0	68.6	35.6	47.4	83.0
1988	27.4	51.3	78.7	43.2	60.7	103.9
1989	29.3	44.8	74.2	62.5	69.0	131.5
1990	24.9	38.6	63.5	63.5	51.2	114.8
1991	23.4	41.0	64.3	36.2	47.8	84.0
1992	28.5	30.0	58.6	38.3	32.4	70.7
1993	22.2	24.5	46.7	34.2	36.2	70.4
1994[1]	20.9	32.6	53.5	42.3	41.4	84.7

[1]Provisional data.
[2]Measured effort.
[3]Derived effort (Landings/CPUE)

Table 3.3.3

Run title : Sole in the Western Channel (Fishing Area VIIe)

At 8/09/1995 6:02

Catch numbers at age Numbers*10**-3 YEAR,	1969,	1970,	1971,	1972,	1973,	1974,
AGE						
1,	0,	0,	1,	0,	0,	0,
2,	89,	53,	51,	146,	71,	45,
3,	322,	232,	201,	412,	396,	349,
4,	90,	322,	246,	167,	433,	220,
5,	149,	90,	198,	115,	89,	178,
6,	210,	83,	65,	113,	99,	71,
7,	21,	112,	80,	14,	120,	80,
8,	50,	13,	156,	25,	17,	43,
9,	26,	35,	10,	134,	52,	32,
+gp,	92,	187,	202,	198,	170,	185,
TOTALNUM,	1037,	1127,	1208,	1323,	1446,	1203,
TONSLAND,	353,	391,	432,	437,	459,	427,
SOPCOF %,	100,	100,	100,	100,	100,	100,

Catch numbers at age Numbers*10**-3 YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	10,	8,	2,	0,	0,	0,	0,	0,	0,	13,
2,	82,	167,	426,	250,	227,	175,	245,	128,	91,	333,
3,	567,	419,	318,	1123,	803,	559,	806,	1451,	753,	663,
4,	170,	472,	384,	347,	811,	497,	651,	916,	1573,	826,
5,	199,	161,	206,	214,	250,	630,	467,	553,	583,	758,
6,	115,	135,	103,	189,	229,	126,	389,	352,	351,	325,
7,	28,	92,	70,	103,	174,	183,	179,	240,	267,	204,
8,	53,	47,	74,	72,	103,	140,	126,	136,	294,	129,
9,	26,	59,	10,	77,	90,	65,	76,	113,	119,	152,
+gp,	217,	278,	214,	269,	422,	528,	324,	435,	371,	337,
TOTALNUM,	1466,	1839,	1807,	2644,	3108,	2902,	3262,	4324,	4401,	3740,
TONSLAND,	491,	616,	606,	861,	1181,	1269,	1215,	1446,	1498,	1370,
SOPCOF %,	98,	100,	100,	99,	101,	100,	100,	101,	100,	100,

Catch numbers at age Numbers*10**-3 YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	0,	0,	1,	20,	14,	49,	13,	2,	0,	0,
2,	287,	240,	445,	421,	379,	292,	493,	302,	183,	76,
3,	1700,	1559,	729,	1323,	739,	740,	351,	1194,	587,	534,
4,	756,	937,	963,	538,	1025,	461,	399,	356,	917,	462,
5,	469,	408,	382,	659,	388,	459,	215,	247,	303,	474,
6,	585,	311,	192,	345,	382,	190,	174,	102,	191,	97,
7,	179,	326,	211,	144,	185,	211,	76,	100,	128,	92,
8,	97,	81,	206,	154,	94,	121,	90,	50,	67,	42,
9,	103,	74,	42,	102,	91,	87,	48,	61,	53,	49,
+gp,	239,	278,	222,	246,	303,	339,	176,	124,	141,	169,
TOTALNUM,	4414,	4214,	3391,	3952,	3600,	2949,	2035,	2538,	2570,	1995,
TONSLAND,	1409,	1368,	1159,	1350,	1161,	1082,	731,	769,	762,	670,
SOPCOF %,	101,	100,	100,	100,	99,	100,	99,	99,	100,	100,

Table 3.3.4

Run title : Sole in the Western Channel (Fishing Area VIIe)

At 8/09/1995 6:02

Catch weights at age (kg)

YEAR,	1969,	1970,	1971,	1972,	1973,	1974,
AGE						
1,	.0000,	.0000,	.1130,	.0000,	.0000,	.1440,
2,	.1880,	.1870,	.1510,	.1940,	.2030,	.1830,
3,	.2450,	.2230,	.2220,	.2270,	.2240,	.2240,
4,	.3320,	.2940,	.2960,	.2720,	.2620,	.2810,
5,	.3290,	.3140,	.3670,	.3690,	.3100,	.3790,
6,	.3670,	.3540,	.3500,	.4080,	.3810,	.4340,
7,	.5220,	.4340,	.3590,	.4580,	.4140,	.3720,
8,	.4550,	.4980,	.4310,	.4950,	.4590,	.4640,
9,	.4630,	.4420,	.4550,	.4020,	.4660,	.4750,
+gp,	.6470,	.5631,	.5514,	.5469,	.5588,	.6228,
SOPCOFAC,	1.0008,	1.0036,	1.0000,	1.0010,	1.0016,	1.0010,

Catch weights at age (kg)

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	.1420,	.1390,	.1180,	.0000,	.0000,	.0000,	.0000,	.1200,	.0000,	.0880,
2,	.1810,	.1700,	.1970,	.1800,	.1870,	.1890,	.1740,	.2130,	.1880,	.2090,
3,	.2140,	.2170,	.2480,	.2410,	.2370,	.2540,	.2260,	.2080,	.2510,	.2420,
4,	.2990,	.2860,	.3020,	.3030,	.3270,	.3430,	.3220,	.2760,	.2720,	.3040,
5,	.3580,	.3230,	.3560,	.3900,	.4230,	.3890,	.3820,	.3450,	.3070,	.3790,
6,	.4030,	.3900,	.3990,	.4390,	.4600,	.5250,	.4780,	.4240,	.3900,	.3890,
7,	.4350,	.4540,	.5020,	.3770,	.4680,	.5600,	.5150,	.4950,	.4190,	.4780,
8,	.4970,	.4130,	.4630,	.4860,	.4770,	.6090,	.5340,	.5070,	.4750,	.5390,
9,	.5910,	.4750,	.5170,	.4890,	.5650,	.6460,	.5990,	.5200,	.5320,	.5590,
+gp,	.6580,	.5978,	.6404,	.6310,	.6646,	.7241,	.6620,	.6201,	.6447,	.6400,
SOPCOFAC,	.9779,	1.0010,	1.0019,	.9916,	1.0093,	1.0007,	.9977,	1.0056,	.9961,	1.0046,

Catch weights at age (kg)

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	.0000,	.1070,	.0940,	.1090,	.1080,	.1400,	.1010,	.0980,	.0730,	.1210,
2,	.1620,	.1660,	.1880,	.1610,	.1590,	.1990,	.1850,	.1690,	.1410,	.1820,
3,	.2250,	.2180,	.2450,	.2420,	.2170,	.2640,	.2650,	.2260,	.2060,	.2400,
4,	.2960,	.3160,	.3070,	.3010,	.2940,	.3200,	.3430,	.3120,	.2670,	.2940,
5,	.3580,	.3780,	.3810,	.3890,	.3290,	.3830,	.4250,	.3870,	.3240,	.3460,
6,	.3890,	.4230,	.4860,	.4380,	.3720,	.4020,	.4490,	.4690,	.3780,	.3940,
7,	.4690,	.4680,	.4260,	.4870,	.4580,	.4880,	.5220,	.4920,	.4280,	.4390,
8,	.5200,	.5410,	.4820,	.5610,	.5080,	.4930,	.5540,	.5650,	.4740,	.4810,
9,	.5310,	.5040,	.5750,	.6050,	.5130,	.5120,	.5910,	.5770,	.5170,	.5200,
+gp,	.6831,	.6318,	.6758,	.6983,	.6537,	.6222,	.7241,	.6926,	.6208,	.6169,
SOPCOFAC,	1.0064,	.9979,	.9996,	1.0002,	.9919,	1.0036,	.9915,	.9934,	.9982,	.9995,

Table 3.3.5

Run title : Sole in the Western Channel (Fishing Area VIIe)

At 8/09/1995 6:02

Stock weights at age (kg)

YEAR,	1969,	1970,	1971,	1972,	1973,	1974,
AGE						
1,	.0400,	.0450,	.0300,	.0550,	.0350,	.0400,
2,	.1250,	.1200,	.0900,	.1300,	.1050,	.1250,
3,	.2000,	.1950,	.1700,	.2000,	.1700,	.2000,
4,	.2700,	.2550,	.2400,	.2650,	.2350,	.2650,
5,	.3300,	.3050,	.2950,	.3250,	.2900,	.3200,
6,	.3800,	.3550,	.3450,	.3800,	.3400,	.3700,
7,	.4250,	.3950,	.3900,	.4200,	.3900,	.4100,
8,	.4600,	.4300,	.4200,	.4600,	.4350,	.4550,
9,	.4900,	.4650,	.4450,	.4900,	.4750,	.4900,
+gp,	.5837,	.5230,	.5168,	.5456,	.5706,	.5517,

Stock weights at age (kg)

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	.0710,	.0950,	.0860,	.0900,	.0640,	.0520,	.0380,	.0380,	.0400,	.0320,
2,	.1440,	.1460,	.1560,	.1560,	.1410,	.1250,	.1190,	.1170,	.1200,	.1080,
3,	.2210,	.1980,	.2210,	.2170,	.2160,	.2060,	.1970,	.1950,	.1950,	.1920,
4,	.2670,	.2470,	.2780,	.2760,	.2870,	.2880,	.2760,	.2650,	.2500,	.2680,
5,	.3270,	.2940,	.3320,	.3300,	.3520,	.3600,	.3580,	.3350,	.3070,	.3390,
6,	.3850,	.3380,	.3820,	.3800,	.4140,	.4360,	.4270,	.3980,	.3650,	.4000,
7,	.4350,	.3800,	.4250,	.4250,	.4630,	.5130,	.4900,	.4550,	.4200,	.4530,
8,	.4790,	.4170,	.4620,	.4630,	.5020,	.5750,	.5430,	.5060,	.4750,	.5010,
9,	.5160,	.4560,	.4970,	.4980,	.5390,	.6200,	.5820,	.5360,	.5200,	.5450,
+gp,	.6128,	.5719,	.6065,	.6075,	.6761,	.6974,	.6749,	.6122,	.6723,	.6693,

Stock weights at age (kg)

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	.0950,	.0720,	.0600,	.0480,	.0800,	.1250,	.0690,	.0530,	.0380,	.0890,
2,	.1500,	.1420,	.1400,	.1330,	.1410,	.1830,	.1500,	.1350,	.1080,	.1520,
3,	.2040,	.2080,	.2140,	.2110,	.2000,	.2380,	.2270,	.2120,	.1740,	.2110,
4,	.2580,	.2700,	.2830,	.2850,	.2570,	.2900,	.2990,	.2830,	.2370,	.2680,
5,	.3110,	.3290,	.3460,	.3530,	.3120,	.3390,	.3660,	.3500,	.2960,	.3210,
6,	.3640,	.3840,	.4040,	.4150,	.3640,	.3840,	.4280,	.4110,	.3510,	.3700,
7,	.4160,	.4350,	.4570,	.4720,	.4130,	.4270,	.4860,	.4670,	.4030,	.4170,
8,	.4680,	.4830,	.5040,	.5220,	.4610,	.4670,	.5390,	.5170,	.4510,	.4610,
9,	.5200,	.5270,	.5460,	.5680,	.5060,	.5030,	.5870,	.5630,	.4960,	.5010,
+gp,	.6922,	.6308,	.6405,	.6787,	.6349,	.6012,	.7133,	.6750,	.6051,	.6031,

Table 3.3.6 Sole in the Western Channel (Fishing Area VIIe) Annual length distributions by fleet 1994.

UK (England & Wales)

Length (cm)*	Beam trawl	Dredge	All gears bar beam & dredge
22			34
23	450		362
24	9310	28	1966
25	51289	1575	5888
26	70885	779	6808
27	110926	2965	11262
28	133617	11082	12500
29	142288	12834	13216
30	116739	14054	13901
31	119751	15373	12095
32	104568	11289	9629
33	96328	11878	11800
34	69733	10884	12196
35	55430	14855	8604
36	53139	7169	5819
37	36261	3979	6208
38	25789	4111	3037
39	21336	2010	3264
40	15667	2121	2846
41	16045	1311	2253
42	12145	1190	1954
43	9006	865	1505
44	8238	974	1184
45	6135	670	1139
46	3557	318	398
47	2571	194	288
48	2159	187	290
49	1096	135	95
50	419	194	81
51	165	54	72
52	188		37
53	80		0
54	19		307
55	68		
Total	1295397	133078	151038

* Lower limit for UK

Table 3.3.7 Sole in the Western Channel (Fishing Area VIIe)

18:10 Tuesday, September 5, 1995

SOL-ECHW: Sole in the Western English Channel (Fishing Area VIIe)

FLT11: UK Inshore fleet

Year	Fishing effort	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12	Catch, age 13	Catch, age 14	Catch, age 15
1973	15.76	28.3	142.9	145.8	28.7	28.7	33.8	4.9	15.2	8.4	1.0	8.4	12.7	1.2	14.3
1974	12.58	17.2	117.7	67.5	51.6	18.0	19.3	11.0	8.2	5.8	12.0	3.1	4.8	2.9	12.2
1975	12.84	30.0	163.3	41.9	45.1	21.2	4.8	10.0	4.9	3.7	3.7	7.0	3.8	5.2	10.2
1976	12.58	63.6	137.5	139.9	44.9	32.6	21.4	11.4	14.4	11.7	2.9	3.7	16.0	4.6	21.1
1977	14.01	169.7	106.7	114.5	57.4	24.3	15.8	18.1	2.5	5.3	6.4	3.5	4.5	8.2	15.3
1978	22.31	117.8	449.7	124.4	72.1	54.5	28.5	21.1	22.5	10.4	6.7	5.8	5.9	3.5	31.9
1979	31.15	114.2	342.9	310.5	89.6	70.2	51.1	32.4	28.1	30.2	7.3	6.8	17.3	3.6	46.0
1980	42.40	131.4	322.7	221.1	257.7	36.9	46.3	37.1	18.1	13.7	32.5	9.2	7.6	8.9	52.3
1981	46.36	161.9	478.9	320.6	190.5	123.1	52.6	37.8	22.1	15.7	12.1	11.3	3.4	3.7	33.2
1982	51.68	86.0	857.6	442.0	215.7	113.5	70.6	43.0	33.6	22.2	16.7	10.3	8.2	7.6	44.2
1983	51.09	76.8	353.4	623.5	210.6	80.1	78.3	94.1	33.8	26.4	5.3	6.5	34.8	5.1	20.9
1984	48.21	177.7	280.2	309.0	257.0	88.6	43.9	39.6	38.1	8.5	5.9	13.9	17.5	4.0	27.7
1985	54.87	57.7	598.4	320.7	168.7	198.1	37.2	29.9	45.9	32.4	17.7	7.6	4.2	5.6	25.3
1986	53.46	103.2	823.1	361.7	111.3	82.9	87.1	23.2	9.3	7.6	17.8	4.2	5.1	9.4	19.2
1987	35.61	116.6	183.2	269.3	93.4	17.1	16.7	32.0	5.9	9.0	3.6	7.3	4.5	5.2	18.4
1988	43.18	78.0	325.9	135.8	201.8	101.1	25.4	26.5	17.4	4.0	1.8	8.4	14.1	1.4	18.3
1989	62.53	79.4	295.8	225.3	81.7	109.0	22.2	17.2	16.6	8.8	14.4	4.3	5.0	4.6	22.6
1990	63.64	123.9	339.6	153.6	125.0	29.8	83.7	14.0	24.2	9.2	16.9	2.2	0.0	6.7	21.1
1991	36.16	292.3	150.9	112.2	53.0	46.4	14.1	34.3	5.1	10.2	4.2	6.8	2.0	0.3	6.6
1992	38.29	133.7	442.1	105.9	74.7	22.5	28.1	9.1	16.9	4.7	2.4	3.1	4.6	6.4	10.9
1993	34.19	115.8	255.6	343.6	59.5	46.3	29.3	23.1	13.0	10.8	6.2	2.8	2.4	3.0	6.9
1994	42.35	34.7	293.0	210.9	198.3	29.9	28.1	12.4	19.8	8.1	11.3	5.4	7.1	2.8	10.0

FLT12: UK Offshore fleet

Year	Fishing effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12	Catch, age 13	Catch, age 14	Catch, age 15
1973	5.64	24.6	37.3	8.9	13.0	16.3	2.1	6.6	4.3	0.7	4.3	4.3	0.7	11.6
1974	6.72	30.3	25.7	23.8	12.2	14.4	7.1	5.4	4.5	11.3	2.3	2.4	2.4	14.9
1975	13.94	85.2	32.5	42.1	29.2	7.3	13.1	6.4	5.8	6.9	10.8	3.8	8.7	25.3
1976	7.36	38.6	58.4	22.7	24.2	17.3	8.1	10.2	9.8	2.9	3.0	8.8	4.2	28.1
1977	9.88	36.1	57.7	34.9	21.7	15.5	15.3	2.1	5.3	7.9	3.5	3.0	8.8	24.5
1978	14.50	140.5	57.7	40.4	44.9	25.8	16.6	17.9	9.7	7.7	5.3	3.6	3.5	47.2
1979	20.38	107.9	145.1	50.6	58.2	46.4	25.5	22.4	28.3	8.3	6.3	10.6	3.7	68.4
1980	28.18	103.1	104.9	147.7	31.1	42.7	29.7	14.7	13.0	37.9	9.8	4.7	9.0	79.1
1981	28.75	142.8	142.1	101.9	96.6	45.3	28.2	16.7	13.9	13.1	10.0	2.0	3.5	46.7
1982	39.85	317.9	243.4	143.3	110.7	75.7	39.9	31.6	24.5	22.5	11.3	5.9	9.0	77.4
1983	66.45	104.1	433.6	167.6	116.5	100.9	104.4	47.3	27.7	19.8	9.2	18.7	10.2	91.4
1984	49.07	152.8	234.7	214.8	133.2	69.9	22.9	54.3	28.5	7.3	29.7	8.2	6.7	55.4
1985	47.15	245.2	130.3	110.8	211.1	75.6	26.7	31.6	15.5	7.1	0.0	7.9	6.8	43.7
1986	34.66	425.5	215.7	100.2	79.1	70.0	15.2	7.9	30.1	28.6	5.3	13.7	7.6	28.0
1987	47.41	158.4	344.2	138.8	53.3	50.7	95.7	22.7	19.0	26.1	13.8	14.2	14.6	36.3
1988	60.72	437.5	302.3	295.9	111.4	45.0	46.6	53.6	12.4	29.4	10.9	14.8	7.6	26.9
1989	68.96	176.3	245.2	132.4	153.4	70.7	28.0	24.7	20.6	13.0	10.2	11.6	7.3	27.1
1990	51.16	164.0	140.8	97.3	68.6	66.9	31.7	18.1	13.6	10.2	7.1	10.9	5.7	28.9
1991	47.77	98.5	104.1	103.8	58.2	33.2	27.9	21.9	8.7	5.0	10.6	3.3	5.5	23.8
1992	32.40	265.2	97.5	71.4	35.3	24.6	17.6	21.2	5.2	4.5	3.1	4.2	1.6	16.5
1993	36.24	90.2	224.2	121.2	67.3	51.8	22.4	20.4	22.2	12.9	3.2	5.2	7.7	15.8
1994	41.34	33.5	105.6	160.3	173.6	50.8	46.4	24.9	18.6	22.6	24.6	10.6	4.9	5.7

FLT13: UK Beam trawl survey

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6
1984	168.4	0	117	143	112	135	45
1985	132.7	0	107	165	42	61	46
1986	147.7	0	50	295	123	55	32
1987	134.3	0	68	114	114	51	20
1988	128.2	2	39	129	52	75	22
1989	165.7	5	56	120	107	34	40
1990	176.0	23	52	76	31	24	7
1991	171.6	11	231	79	51	23	21
1992	196.6	5	140	316	44	36	12
1993	188.2	5	54	115	105	14	10
1994	205.9	6	47	106	62	44	5

Table 3.3.8

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Lowestoft VPA Version 3.1

   8/09/1995   6:47

Extended Survivors Analysis

Sole in the Western Channel (Fishing Area VIIe)

CPUE data from file a:\7e\SOL7ETUN.DAT

Catch data for  26 years. 1969 to 1994. Ages  1 to  10.

     Fleet,            First, Last, First, Last, Alpha,  Beta
                     ,  year, year,  age ,  age
UK Inshore fleet     ,  1973, 1994,   2,     9,   .000,  1.000
UK Offshore fleet    ,  1973, 1994,   3,     9,   .000,  1.000
UK Beam trawl survey,   1984, 1994,   1,     6,   .750,   .800


Time series weights :

     Tapered time weighting applied
     Power =    3 over  20 years


Catchability analysis :

     Catchability dependent on stock size for ages <    7

        Regression type = C
        Minimum of   5 points used for regression
        Survivor estimates shrunk to the population mean for ages <  7


     Catchability independent of age for ages >=    7


Terminal population estimation :

     Survivor estimates shrunk towards the mean F
     of the final   5 years or the   3 oldest ages.

     S.E. of the mean to which the estimates  are shrunk =   1.000

     Minimum standard error for population
     estimates derived from each fleet =    .300

     Prior weighting not applied

Tuning had not converged after   30 iterations


Total absolute residual between iterations
29 and  30 =     .00191

Final year F values
Age             ,      1,      2,      3,      4,      5,      6,      7,      8,      9
Iteration 29,   .0000,  .0298,  .2520,  .2686,  .3165,  .1518,  .2074,  .1332,  .2072
Iteration 30,   .0000,  .0298,  .2518,  .2684,  .3163,  .1516,  .2070,  .1330,  .2067
```

Table 3.3.8 (cont'd.)

Log catchability residuals.

Fleet : UK Inshore fleet

Age	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	No data for this fleet at this age									
2	.18	1.12	1.28	.72	.46	.14	-.28	-.49	-.41	.14
3	.54	.44	.26	.29	.15	-.04	.08	-.09	-.21	-.15
4	.16	.59	.35	.20	-.09	-.19	.10	.17	-.13	.00
5	.21	.42	.25	.01	.04	-.08	-.04	.19	.20	-.20
6	-.11	.26	.24	.18	.05	-.36	-.26	-.06	.11	.24
7	.20	.28	.01	.37	.45	-.03	.07	-.19	.35	.35
8	.11	1.41	.21	.04	.47	.20	.03	.13	.52	.16
9	.16	.74	.10	.19	.25	-.09	-.04	.18	.33	.15

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	No data for this fleet at this age									
2	-1.33	-.04	.10	-.05	-.45	.20	.99	.54	.66	-.79
3	.03	.15	-.09	-.18	-.05	.00	-.06	.04	.12	.20
4	.17	.10	-.09	-.05	-.25	-.09	.00	-.06	.19	.08
5	-.03	.00	-.02	.04	-.16	-.06	-.02	.05	-.01	.13
6	-.04	.01	-.34	.36	-.07	-.16	.21	-.16	.23	-.11
7	.06	.22	-.53	-.06	-.59	.35	-.29	.08	.25	-.02
8	.39	.08	.11	.30	-.36	-.49	.41	-.48	.31	-.50
9	.58	-.19	-.50	-.24	.12	.54	-.40	-.05	.34	.25

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	7	8	9
Mean Log q	-6.4841	-6.4841	-6.4841
S.E(Log q)	.3183	.3787	.3456

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	1.08	-.121	7.26	.20	20	.66	-7.33
3	.79	1.619	6.37	.86	20	.14	-5.91
4	.64	2.504	6.56	.83	20	.15	-5.90
5	.65	3.152	6.52	.89	20	.11	-6.09
6	.56	2.038	6.60	.68	20	.22	-6.42

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
7	.78	.922	6.47	.63	20	.25	-6.48
8	.63	1.930	6.30	.73	20	.21	-6.46
9	.84	.730	6.29	.66	20	.29	-6.41

Table 3.3.8 (Cont'd)

Fleet : UK Offshore fleet

Age	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	.42	.36	.28	.05	.06	-.02	.01	-.28	-.58	-.02
4	-.09	.67	.35	.09	-.04	-.31	.07	.21	-.27	.00
5	.04	.27	.17	-.21	-.23	.10	-.09	.19	-.21	-.14
6	-.26	.33	.12	.24	.07	-.80	-.16	-.03	-.11	.38
7	.10	.16	-.10	.26	.34	-.14	-.04	-.30	-.10	.36
8	-.14	1.17	-.05	-.21	.22	-.05	-.23	-.13	-.08	-.85
9	-.09	.49	-.16	-.05	.01	-.33	-.28	-.06	-.03	.05

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	-.08	.23	.17	.18	.12	.21	.12	.14	-.06	-.52
4	-.27	.31	.17	.44	-.14	.03	-.26	.05	.13	-.35
5	-.37	.18	.01	.34	-.16	-.34	.00	-.10	.45	.12
6	.21	.04	-.38	-.04	-.13	.00	-.31	-.38	.11	.94
7	.48	-.01	-.14	-.27	.03	-.10	-.15	-.33	.33	.15
8	-.02	-.34	.48	.09	-.41	.10	-.51	-.09	-.21	.40
9	-.08	-.36	.12	.10	-.02	.03	.34	-.09	.30	.07

.ean log catchability and standard error of ages with catchability
ındependent of year class strength and constant w.r.t. time

Age	7	8	9
Mean Log q	-6.0452	-6.0452	-6.0452
S.E(Log q)	.2507	.3688	.1951

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
3	.54	1.866	7.33	.62	20	.27	-6.65
4	.90	.380	6.27	.61	20	.26	-6.12
5	1.22	-.847	5.74	.60	20	.26	-6.02
6	1.02	-.054	5.93	.40	20	.40	-5.95

Ages with q independent of year class strength and constant w.r.t. time.

ge	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
7	1.15	-.531	5.98	.54	20	.30	-6.05
8	1.01	-.029	6.15	.47	20	.37	-6.15
9	1.14	-.819	6.08	.76	20	.23	-6.03

Table 3.3.8 (Cont'd)

Fleet : UK Beam trawl survey

Age	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
2	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-.12
3	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	.02
4	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	.03
5	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-.03
6	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	.34
7	No data for this fleet at this age									
8	No data for this fleet at this age									
9	No data for this fleet at this age									

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	99.99	99.99	99.99	-.35	.14	.06	.20	-.03	.08	-.11
2	-.14	-.06	-.23	-.07	-.03	.08	.30	.35	-.07	-.14
3	-.05	.07	.18	-.10	.19	-.16	.00	.06	-.11	-.07
4	-.12	.22	-.04	.18	.15	-.11	.08	-.06	-.16	-.15
5	.19	.37	.20	.14	.19	-.20	.00	.05	-.42	-.34
6	-.22	.11	.27	.14	.01	-.07	.19	-.03	-.16	-.46
7	No data for this fleet at this age									
8	No data for this fleet at this age									
9	No data for this fleet at this age									

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	.44	1.691	9.64	.65	7	.20	-11.46
2	.63	1.666	8.64	.72	11	.20	-8.88
3	.60	2.969	8.00	.87	11	.12	-7.95
4	.51	2.624	7.95	.78	11	.15	-8.21
5	.55	1.545	7.84	.60	11	.27	-8.33
6	.40	2.170	7.54	.62	11	.25	-8.68

Table 3.3.8 (Cont'd)

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
UK Inshore fleet ,	1,	.000,	.000,	.00,	0,	.000,	.000
UK Offshore fleet ,	1,	.000,	.000,	.00,	0,	.000,	.000
UK Beam trawl survey,	3057,	.300,	.000,	.00,	1,	.518,	.000
P shrinkage mean ,	3875,	.31,,,,				.482,	.000
F shrinkage mean ,	0,	1.00,,,,				.000,	.000

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
3427,	.22,	.16,	2,	.763,	.000

Age 2 Catchability dependent on age and year class strength

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
UK Inshore fleet ,	1081,	.759,	.000,	.00,	1,	.050,	.065
UK Offshore fleet ,	1,	.000,	.000,	.00,	0,	.000,	.000
UK Beam trawl survey,	2316,	.212,	.107,	.51,	2,	.638,	.031
P shrinkage mean ,	3368,	.32,,,,				.283,	.021
F shrinkage mean ,	672,	1.00,,,,				.030,	.102

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
2390,	.17,	.18,	5,	1.050,	.030

Age 3 Catchability dependent on age and year class strength

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
UK Inshore fleet ,	2328,	.276,	.163,	.59,	2,	.187,	.197
UK Offshore fleet ,	1051,	.319,	.000,	.00,	1,	.141,	.394
UK Beam trawl survey,	1677,	.173,	.011,	.06,	3,	.458,	.265
P shrinkage mean ,	2324,	.31,,,,				.195,	.198
F shrinkage mean ,	1478,	1.00,,,,				.018,	.295

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1775,	.12,	.11,	8,	.862,	.252

Table 3.3.8 (Cont'd)

Age 4 Catchability dependent on age and year class strength

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
UK Inshore fleet ,	1621,	.205,	.082,	.40,	3,	.230,	.240
UK Offshore fleet ,	1143,	.214,	.142,	.66,	2,	.215,	.325
UK Beam trawl survey,	1502,	.152,	.122,	.80,	4,	.385,	.257
P shrinkage mean ,	1473,	.30,,,,				.156,	.261
F shrinkage mean ,	968,	1.00,,,,				.014,	.374

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
1428,	.10,	.06,	11,	.644,	.268

Age 5 Catchability dependent on age and year class strength

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
UK Inshore fleet ,	1414,	.177,	.089,	.50,	4,	.253,	.277
UK Offshore fleet ,	1379,	.180,	.006,	.04,	3,	.246,	.283
UK Beam trawl survey,	1110,	.143,	.113,	.79,	5,	.344,	.341
P shrinkage mean ,	931,	.31,,,,				.143,	.395
F shrinkage mean ,	1058,	1.00,,,,				.014,	.355

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
1213,	.09,	.06,	14,	.661,	.316

Age 6 Catchability dependent on age and year class strength

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
UK Inshore fleet ,	532,	.154,	.029,	.19,	5,	.292,	.160
UK Offshore fleet ,	823,	.168,	.190,	1.13,	4,	.226,	.106
UK Beam trawl survey,	463,	.132,	.109,	.82,	6,	.357,	.182
P shrinkage mean ,	625,	.31,,,,				.114,	.138
F shrinkage mean ,	260,	1.00,,,,				.011,	.303

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
565,	.08,	.08,	17,	.946,	.152

Table 3.3.8 (Cont'd)

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
UK Inshore fleet ,	402,	.146,	.053,	.37,	6,	.353,	.197
UK Offshore fleet ,	394,	.154,	.081,	.53,	5,	.326,	.200
UK Beam trawl survey,	353,	.135,	.059,	.44,	6,	.307,	.222
F shrinkage mean ,	243,	1.00,,,,				.014,	.308

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
381,	.08,	.04,	18,	.457,	.207

Age 8 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1986

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
UK Inshore fleet ,	254,	.141,	.101,	.72,	7,	.385,	.146
UK Offshore fleet ,	329,	.148,	.108,	.73,	6,	.356,	.115
UK Beam trawl survey,	277,	.148,	.043,	.29,	5,	.246,	.135
F shrinkage mean ,	113,	1.00,,,,				.014,	.302

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
281,	.09,	.06,	19,	.736,	.133

Age 9 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1985

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
UK Inshore fleet ,	233,	.144,	.063,	.44,	8,	.397,	.182
UK Offshore fleet ,	176,	.146,	.074,	.51,	7,	.421,	.235
UK Beam trawl survey,	207,	.160,	.091,	.57,	5,	.166,	.203
F shrinkage mean ,	261,	1.00,,,,				.016,	.164

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
203,	.09,	.05,	21,	.548,	.207

Table 3.3.9

Run title : Sole in the Western Channel (Fishing Area VIIe)

At 8/09/1995 6:48

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1969,	1970,	1971,	1972,	1973,	1974,
AGE						
1,	.0000,	.0000,	.0002,	.0000,	.0000,	.0001,
2,	.0464,	.0518,	.0175,	.0580,	.0349,	.0146,
3,	.2056,	.1475,	.2491,	.1731,	.1977,	.2139,
4,	.1398,	.2913,	.2061,	.3020,	.2480,	.1440,
5,	.1932,	.2060,	.2611,	.1264,	.2322,	.1367,
6,	.0982,	.1406,	.2033,	.2073,	.1362,	.2631,
7,	.2028,	.0630,	.1760,	.0563,	.3163,	.1392,
8,	.1388,	.1625,	.1048,	.0679,	.0772,	.1585,
9,	.1469,	.1223,	.1617,	.1107,	.1770,	.1874,
+gp,	.1469,	.1223,	.1617,	.1107,	.1770,	.1874,
FBAR 3- 7,	.1679,	.1697,	.2191,	.1730,	.2261,	.1794,

Table 8 Fishing mortality (F) at age

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	.0034,	.0012,	.0005,	.0000,	.0000,	.0000,	.0000,	.0001,	.0000,	.0020,
2,	.0276,	.0625,	.0727,	.0600,	.0620,	.0416,	.0338,	.0316,	.0272,	.0657,
3,	.2313,	.1724,	.1455,	.2481,	.2474,	.1908,	.2431,	.2554,	.2347,	.2521,
4,	.1373,	.2736,	.2110,	.2091,	.2546,	.2134,	.3159,	.4243,	.4286,	.3871,
5,	.1683,	.1674,	.1643,	.1565,	.2047,	.2859,	.2836,	.4289,	.4641,	.3352,
6,	.1106,	.1481,	.1372,	.2002,	.2231,	.1353,	.2560,	.3185,	.4706,	.4523,
7,	.1380,	.1092,	.0953,	.1789,	.2545,	.2491,	.2579,	.2218,	.3786,	.4872,
8,	.1161,	.3224,	.1086,	.1209,	.2434,	.2993,	.2439,	.2847,	.4106,	.2827,
9,	.1218,	.1633,	.0968,	.1405,	.1957,	.2125,	.2333,	.3184,	.3816,	.3419,
+gp,	.1218,	.1633,	.0968,	.1405,	.1957,	.2125,	.2333,	.3184,	.3816,	.3419,
FBAR 3- 7,	.1571,	.1741,	.1507,	.1986,	.2369,	.2149,	.2713,	.3298,	.3954,	.3828,

Table 8 Fishing mortality (F) at age

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	FBAR 92-9
AGE											
1,	.0000,	.0000,	.0003,	.0058,	.0050,	.0083,	.0035,	.0006,	.0000,	.0000,	.0002,
2,	.0505,	.0795,	.0962,	.1474,	.1298,	.1215,	.0978,	.0945,	.0667,	.0298,	.0637,
3,	.4830,	.3725,	.3256,	.4029,	.3688,	.3553,	.1883,	.3215,	.2395,	.2518,	.2709,
4,	.4479,	.4749,	.3682,	.3773,	.5532,	.3674,	.2934,	.2642,	.3884,	.2684,	.3070,
5,	.3517,	.4113,	.3197,	.4106,	.4542,	.4552,	.2599,	.2656,	.3347,	.3163,	.3055,
6,	.4151,	.3689,	.3067,	.4725,	.3933,	.3728,	.2764,	.1691,	.3011,	.1516,	.2073,
7,	.4271,	.3806,	.4080,	.3550,	.4430,	.3483,	.2228,	.2259,	.2951,	.2070,	.2427,
8,	.4028,	.3121,	.3913,	.5192,	.3662,	.5156,	.2187,	.2002,	.2079,	.1330,	.1803,
9,	.3376,	.5406,	.2327,	.3041,	.5906,	.6021,	.3507,	.2022,	.3006,	.2067,	.2365,
+gp,	.3376,	.5406,	.2327,	.3041,	.5906,	.6021,	.3507,	.2022,	.3006,	.2067,	
FBAR 3- 7,	.4250,	.4017,	.3456,	.4037,	.4425,	.3798,	.2481,	.2493,	.3118,	.2390,	

Table 3.3.10

Run title : Sole in the Western Channel (Fishing Area VIIe)

At 8/09/1995 6:48

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR,	1969,	1970,	1971,	1972,	1973,	1974,
AGE						
1,	1230,	3385,	3006,	2410,	3579,	3497,
2,	2058,	1113,	3063,	2720,	2181,	3239,
3,	1819,	1777,	956,	2723,	2322,	1906,
4,	642,	1340,	1388,	674,	2073,	1724,
5,	989,	505,	906,	1022,	451,	1463,
6,	2358,	663,	372,	632,	815,	324,
7,	121,	1934,	521,	275,	464,	643,
8,	402,	90,	1643,	395,	235,	306,
9,	196,	317,	69,	1339,	334,	197,
+gp,	707,	1706,	1419,	1985,	1101,	1138,
TOTAL,	10422,	12831,	13343,	14175,	13556,	14438,

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	3220,	7068,	4996,	4395,	5000,	8551,	4767,	3927,	6086,	6786,
2,	3164,	2904,	6388,	4518,	3976,	4524,	7737,	4314,	3553,	5507,
3,	2888,	2785,	2468,	5375,	3850,	3382,	3927,	6768,	3782,	3129,
4,	1392,	2074,	2121,	1931,	3795,	2720,	2528,	2786,	4744,	2706,
5,	1351,	1098,	1427,	1554,	1417,	2662,	1988,	1668,	1649,	2796,
6,	1155,	1033,	841,	1096,	1202,	1045,	1810,	1355,	983,	938,
7,	225,	936,	806,	663,	812,	870,	826,	1267,	892,	556,
8,	507,	177,	759,	663,	502,	569,	614,	577,	919,	552,
9,	237,	408,	116,	616,	532,	356,	382,	435,	393,	551,
+gp,	1983,	1936,	2438,	2152,	2488,	2892,	1632,	1672,	1226,	1220,
TOTAL,	16122,	20419,	22359,	22963,	23573,	27571,	26211,	24770,	24227,	24742,

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	GMST 69-92	AMST 69-92
AGE													
1,	3644,	5639,	3566,	3639,	2980,	6200,	3903,	3295,	3005,	3786,	0,	4057,	4365,
2,	6128,	3298,	5102,	3226,	3273,	2684,	5564,	3519,	2979,	2719,	3427,	3610,	3906,
3,	4666,	5272,	2756,	4193,	2519,	2601,	2150,	4565,	2897,	2522,	2390,	3007,	3274,
4,	2200,	2605,	3287,	1801,	2536,	1576,	1650,	1612,	2995,	2063,	1775,	1968,	2163,
5,	1663,	1272,	1466,	2058,	1117,	1320,	988,	1113,	1120,	1838,	1428,	1300,	1410,
6,	1809,	1058,	763,	963,	1235,	642,	757,	689,	772,	725,	1213,	930,	1022,
7,	540,	1081,	662,	508,	543,	754,	400,	520,	527,	517,	565,	610,	701,
8,	309,	319,	668,	398,	322,	316,	482,	290,	375,	355,	381,	428,	501,
9,	377,	187,	211,	409,	214,	202,	171,	350,	215,	276,	281,	300,	358,
+gp,	873,	697,	1121,	985,	710,	784,	623,	711,	569,	949,	902,		
TOTAL,	22210,	21427,	19602,	18179,	15451,	17079,	16688,	16664,	15455,	15750,	12363,		

Table 3.3.11

Run title : Sole in the Western Channel (Fishing Area VIIe)

At 8/09/1995 6:48

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 3- 7,
1969,	1230,	2778,	2472,	353,	.1428,	.1679,
1970,	3385,	3206,	2920,	391,	.1339,	.1697,
1971,	3006,	2914,	2549,	432,	.1695,	.2191,
1972,	2410,	3818,	3332,	437,	.1312,	.1730,
1973,	3579,	2715,	2360,	459,	.1945,	.2261,
1974,	3497,	3098,	2554,	427,	.1672,	.1794,
1975,	3220,	4258,	3574,	491,	.1374,	.1571,
1976,	7068,	4554,	3458,	616,	.1781,	.1741,
1977,	4996,	5586,	4159,	606,	.1457,	.1507,
1978,	4395,	5932,	4832,	861,	.1782,	.1986,
1979,	5000,	6394,	5514,	1181,	.2142,	.2369,
1980,	8551,	6915,	5905,	1269,	.2149,	.2149,
1981,	4767,	6119,	5017,	1215,	.2422,	.2713,
1982,	3927,	5936,	5282,	1446,	.2738,	.3298,
1983,	6086,	5298,	4628,	1498,	.3237,	.3954,
1984,	6786,	5107,	4295,	1370,	.3190,	.3828,
1985,	3644,	5130,	3865,	1409,	.3646,	.4250,
1986,	5639,	4661,	3787,	1368,	.3612,	.4017,
1987,	3566,	4736,	3808,	1159,	.3044,	.3456,
1988,	3639,	4476,	3873,	1350,	.3486,	.4037,
1989,	2980,	3586,	2886,	1161,	.4023,	.4425,
1990,	6200,	4078,	2812,	1082,	.3847,	.3798,
1991,	3903,	3770,	2666,	731,	.2742,	.2481,
1992,	3295,	3816,	3166,	769,	.2429,	.2493,
1993,	3005,	3085,	2649,	762,	.2877,	.3118,
1994,	3786,	3783,	3033,	670,	.2209,	.2390,
Arith. Mean ,	4291,	4452,	3669,	904,	.2445,	.2728,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

Table 3.3.12

Sole in the Western English Channel (Fishing Area VIIe)

08:05 Saturday, September 9, 1995

Single option prediction: Input data

Year: 1995								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	4057.000	0.1000	0.0000	0.0000	0.0000	0.060	0.0002	0.097
2	3427.000	0.1000	0.0000	0.0000	0.0000	0.132	0.0571	0.164
3	2390.000	0.1000	1.0000	0.0000	0.0000	0.199	0.2428	0.224
4	1775.000	0.1000	1.0000	0.0000	0.0000	0.263	0.2751	0.291
5	1428.000	0.1000	1.0000	0.0000	0.0000	0.322	0.2738	0.352
6	1213.000	0.1000	1.0000	0.0000	0.0000	0.377	0.1858	0.414
7	565.000	0.1000	1.0000	0.0000	0.0000	0.429	0.2175	0.453
8	381.000	0.1000	1.0000	0.0000	0.0000	0.476	0.1616	0.507
9	281.000	0.1000	1.0000	0.0000	0.0000	0.520	0.2119	0.538
10+	902.000	0.1000	1.0000	0.0000	0.0000	0.628	0.2119	0.643
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1996								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	4057.000	0.1000	0.0000	0.0000	0.0000	0.060	0.0002	0.097
2	.	0.1000	0.0000	0.0000	0.0000	0.132	0.0571	0.164
3	.	0.1000	1.0000	0.0000	0.0000	0.199	0.2428	0.224
4	.	0.1000	1.0000	0.0000	0.0000	0.263	0.2751	0.291
5	.	0.1000	1.0000	0.0000	0.0000	0.322	0.2738	0.352
6	.	0.1000	1.0000	0.0000	0.0000	0.377	0.1858	0.414
7	.	0.1000	1.0000	0.0000	0.0000	0.429	0.2175	0.453
8	.	0.1000	1.0000	0.0000	0.0000	0.476	0.1616	0.507
9	.	0.1000	1.0000	0.0000	0.0000	0.520	0.2119	0.538
10+	.	0.1000	1.0000	0.0000	0.0000	0.628	0.2119	0.643
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	4057.000	0.1000	0.0000	0.0000	0.0000	0.060	0.0002	0.097
2	.	0.1000	0.0000	0.0000	0.0000	0.132	0.0571	0.164
3	.	0.1000	1.0000	0.0000	0.0000	0.199	0.2428	0.224
4	.	0.1000	1.0000	0.0000	0.0000	0.263	0.2751	0.291
5	.	0.1000	1.0000	0.0000	0.0000	0.322	0.2738	0.352
6	.	0.1000	1.0000	0.0000	0.0000	0.377	0.1858	0.414
7	.	0.1000	1.0000	0.0000	0.0000	0.429	0.2175	0.453
8	.	0.1000	1.0000	0.0000	0.0000	0.476	0.1616	0.507
9	.	0.1000	1.0000	0.0000	0.0000	0.520	0.2119	0.538
10+	.	0.1000	1.0000	0.0000	0.0000	0.628	0.2119	0.643
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : PRED95
Date and time: 09SEP95:08:31

Table 3.3.13

Sole in the Western English Channel (Fishing Area VIIe)

08:05 Saturday, September 9, 1995

Yield per recruit: Summary table

						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	10.508	4369.103	8.603	4189.966	8.603	4189.966
0.1000	0.0239	0.153	71.184	8.979	3468.594	7.074	3289.459	7.074	3289.459
0.2000	0.0478	0.261	115.735	7.906	2850.115	6.001	2670.982	6.001	2670.982
0.3000	0.0717	0.340	144.735	7.113	2402.809	5.208	2223.679	5.208	2223.679
0.4000	0.0956	0.401	164.081	6.503	2066.796	4.598	1887.669	4.598	1887.669
0.5000	0.1195	0.450	177.163	6.021	1806.937	4.116	1627.812	4.116	1627.812
0.6000	0.1434	0.489	186.049	5.630	1601.281	3.725	1422.158	3.725	1422.158
0.7000	0.1673	0.521	192.053	5.307	1435.432	3.402	1256.311	3.402	1256.311
0.8000	0.1912	0.549	196.043	5.036	1299.571	3.131	1120.453	3.131	1120.453
0.9000	0.2151	0.572	198.606	4.806	1186.786	2.901	1007.671	2.901	1007.671
1.0000	0.2390	0.592	200.147	4.608	1092.077	2.703	912.964	2.703	912.964
1.1000	0.2629	0.609	200.953	4.436	1011.744	2.532	832.634	2.532	832.634
1.2000	0.2868	0.624	201.227	4.286	942.999	2.381	763.891	2.381	763.891
1.3000	0.3107	0.638	201.118	4.153	883.701	2.249	704.595	2.249	704.595
1.4000	0.3346	0.650	200.732	4.036	832.185	2.131	653.082	2.131	653.082
1.5000	0.3585	0.660	200.150	3.931	787.139	2.026	608.037	2.026	608.037
1.6000	0.3824	0.670	199.429	3.836	747.514	1.932	568.415	1.932	568.415
1.7000	0.4063	0.678	198.614	3.751	712.467	1.847	533.371	1.847	533.371
1.8000	0.4302	0.686	197.736	3.674	681.313	1.769	502.219	1.769	502.219
1.9000	0.4541	0.694	196.819	3.604	653.487	1.699	474.396	1.699	474.396
2.0000	0.4780	0.700	195.883	3.539	628.525	1.635	449.436	1.635	449.436
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YPR95
Date and time : 09SEP95:09:06
Computation of ref. F: Simple mean, age 3 - 7
F-0.1 factor : 0.5434
F-max factor : 1.2166
F-0.1 reference F : 0.1299
F-max reference F : 0.2908
Recruitment : Single recruit

Table 3.3.14

Sole in the Western English Channel (Fishing Area VIIe)

08:05 Saturday, September 9, 1995

Prediction with management option table

Year: 1995					Year: 1996					Year: 1997	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.2390	3691	2996	663	0.0000	0.0000	3802	3075	0	4621	3894
.	.	.	.	.	0.1000	0.0239	.	3075	75	4544	3817
.	.	.	.	.	0.2000	0.0478	.	3075	148	4468	3741
.	.	.	.	.	0.3000	0.0717	.	3075	220	4394	3667
.	.	.	.	.	0.4000	0.0956	.	3075	290	4321	3595
.	.	.	.	.	0.5000	0.1195	.	3075	359	4251	3524
.	.	.	.	.	0.6000	0.1434	.	3075	426	4181	3455
.	.	.	.	.	0.7000	0.1673	.	3075	492	4114	3387
.	.	.	.	.	0.8000	0.1912	.	3075	556	4048	3321
.	.	.	.	.	0.9000	0.2151	.	3075	619	3983	3256
.	.	.	.	.	1.0000	0.2390	.	3075	681	3920	3193
.	.	.	.	.	1.1000	0.2629	.	3075	741	3858	3131
.	.	.	.	.	1.2000	0.2868	.	3075	800	3797	3071
.	.	.	.	.	1.3000	0.3107	.	3075	857	3738	3011
.	.	.	.	.	1.4000	0.3346	.	3075	913	3680	2954
.	.	.	.	.	1.5000	0.3585	.	3075	968	3624	2897
.	.	.	.	.	1.6000	0.3824	.	3075	1022	3568	2842
.	.	.	.	.	1.7000	0.4063	.	3075	1075	3514	2788
.	.	.	.	.	1.8000	0.4302	.	3075	1127	3461	2735
.	.	.	.	.	1.9000	0.4541	.	3075	1177	3410	2683
.	.	.	.	.	2.0000	0.4780	.	3075	1226	3359	2633
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : PREDMO95
Date and time : 09SEP95:08:58
Computation of ref. F: Simple mean, age 3 - 7
Basis for 1995 : F factors

Table 3.3.15

Sole in the Western English Channel (Fishing Area VIIe)

08:05 Saturday, September 9, 1995

Single option prediction: Detailed tables

Year: 1995 F-factor: 1.0000 Reference F: 0.2390

Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1	0.0002	1	0	4057	243	0	0	0	0
2	0.0571	181	30	3427	451	0	0	0	0
3	0.2428	491	110	2390	476	2390	476	2390	476
4	0.2751	407	118	1775	466	1775	466	1775	466
5	0.2738	326	115	1428	460	1428	460	1428	460
6	0.1858	196	81	1213	458	1213	458	1213	458
7	0.2175	105	48	565	242	565	242	565	242
8	0.1616	54	27	381	181	381	181	381	181
9	0.2119	51	28	281	146	281	146	281	146
10+	0.2119	164	106	902	566	902	566	902	566
Total		1977	663	16419	3691	8935	2996	8935	2996
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1996 F-factor: 1.0000 Reference F: 0.2390

Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1	0.0002	1	0	4057	243	0	0	0	0
2	0.0571	194	32	3670	483	0	0	0	0
3	0.2428	602	135	2929	583	2929	583	2929	583
4	0.2751	389	113	1696	446	1696	446	1696	446
5	0.2738	279	98	1220	393	1220	393	1220	393
6	0.1858	159	66	983	371	983	371	983	371
7	0.2175	170	77	911	391	911	391	911	391
8	0.1616	58	30	411	196	411	196	411	196
9	0.2119	53	29	293	153	293	153	293	153
10+	0.2119	158	101	866	544	866	544	866	544
Total		2063	681	17037	3802	9310	3075	9310	3075
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1997 F-factor: 1.0000 Reference F: 0.2390

Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1	0.0002	1	0	4057	243	0	0	0	0
2	0.0571	194	32	3670	483	0	0	0	0
3	0.2428	645	144	3137	624	3137	624	3137	624
4	0.2751	477	139	2079	546	2079	546	2079	546
5	0.2738	266	94	1166	376	1166	376	1166	376
6	0.1858	136	56	839	317	839	317	839	317
7	0.2175	138	62	738	317	738	317	738	317
8	0.1616	94	48	664	316	664	316	664	316
9	0.2119	58	31	317	165	317	165	317	165
10+	0.2119	154	99	849	533	849	533	849	533
Total		2162	706	17515	3920	9788	3193	9788	3193
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : PRED95
Date and time : 09SEP95:08:31
Computation of ref. F: Simple mean, age 3 - 7
Prediction basis : F factors

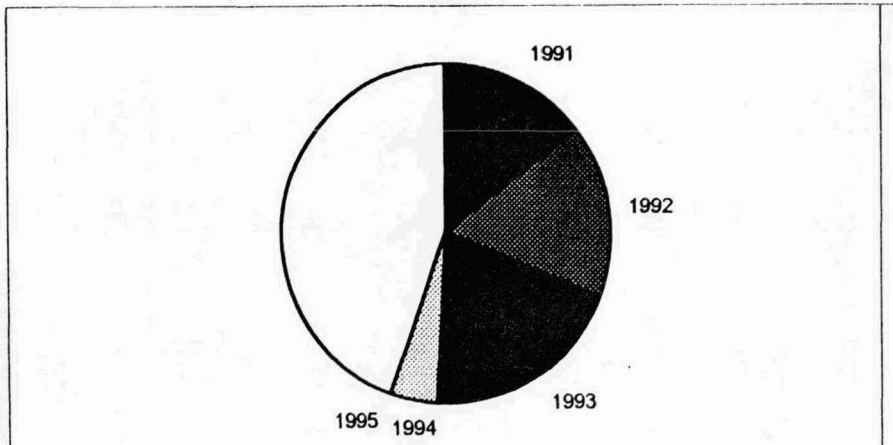
Table 3.3.16 Western Channel Sole. Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class	1991	1992	1993	1994	1995
Stock No. (thousands) of one-year-olds	3295	3005	3786	4057	4057
Source	VPA	VPA	VPA	GM	GM
Status Quo F:					
% in 1995 catch	17.8	16.6	4.5	0.0	-
% in 1996 catch	14.4	16.6	19.8	4.7	0.0
% in 1995 SSB	15.6	15.9	0.0	0.0	-
% in 1996 SSB	12.8	14.5	18.9	0.0	0.0
% in 1997 SSB	9.9	11.8	17.1	19.5	0.0

GM= geometric mean recruitment

VIIe sole : Year-class % contribution to a) 1996 landings and b) 1997 SSB

a



b

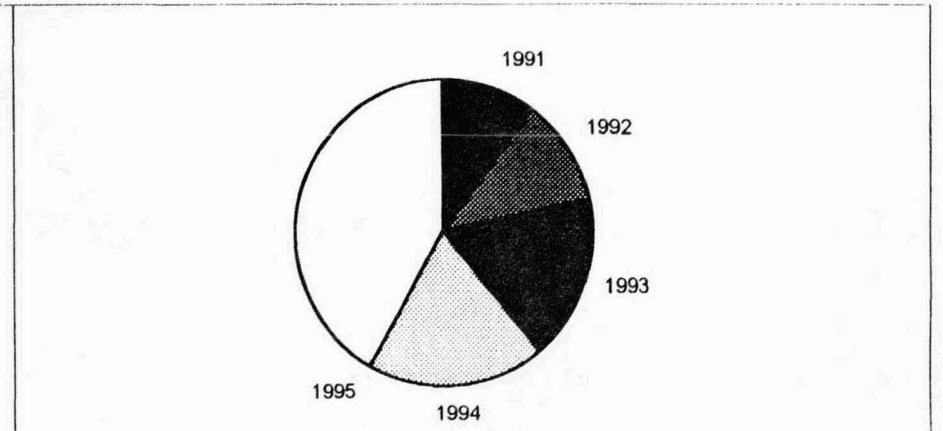


Figure 3.3.1a **VIIe SOLE XSA LOG CATCHABILITY RESIDUAL PLOTS (AGES 1-6)**

UK Inshore fleet ■
UK Ofshore fleet ♦
UK Beam trawl survey ▲

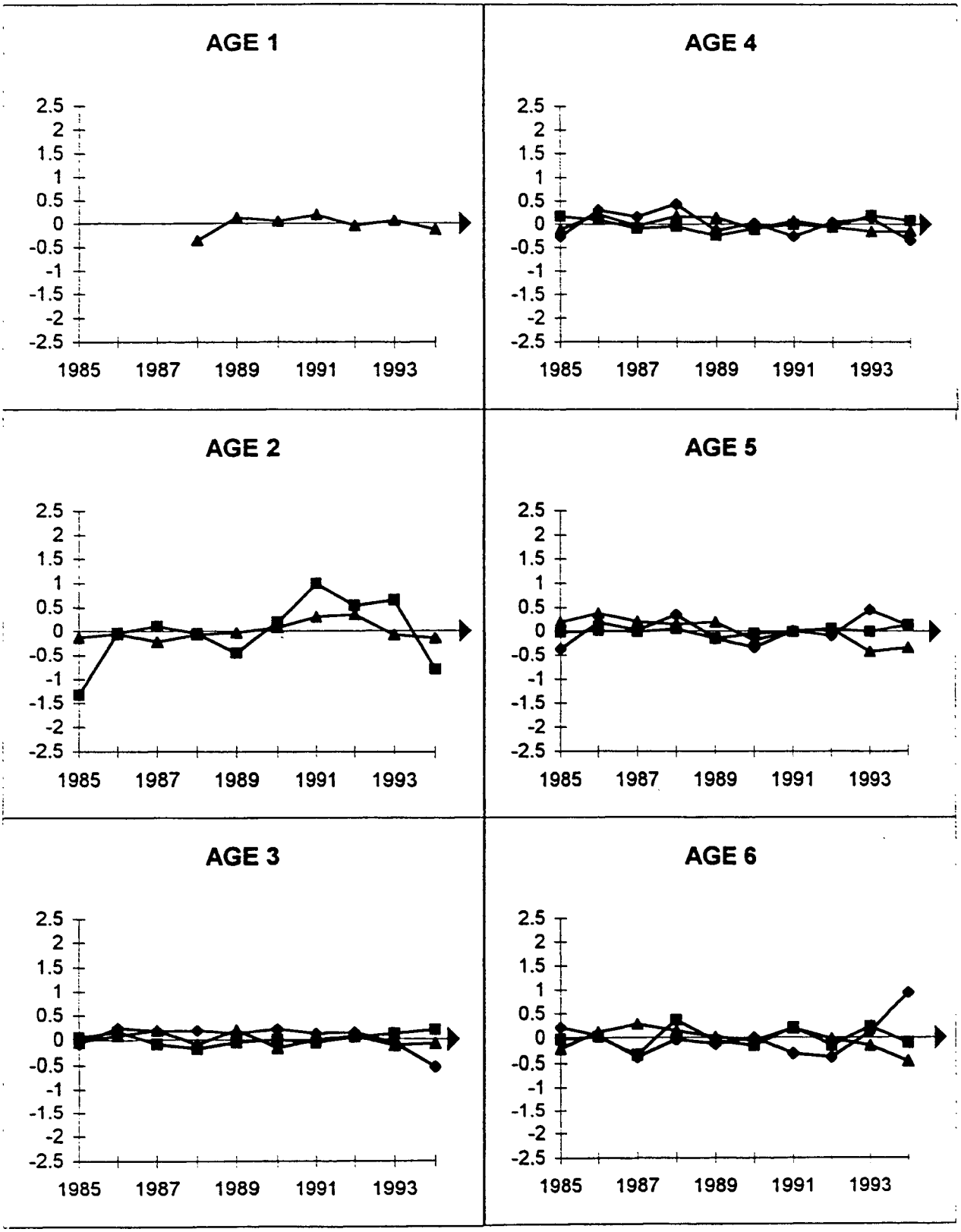


Figure 3.3.1b **VIIe SOLE XSA LOG CATCHABILITY RESIDUAL PLOTS (AGES 7-9)**

UK Inshore fleet ■

UK Ofshore fleet ◆

UK Beam trawl survey ●

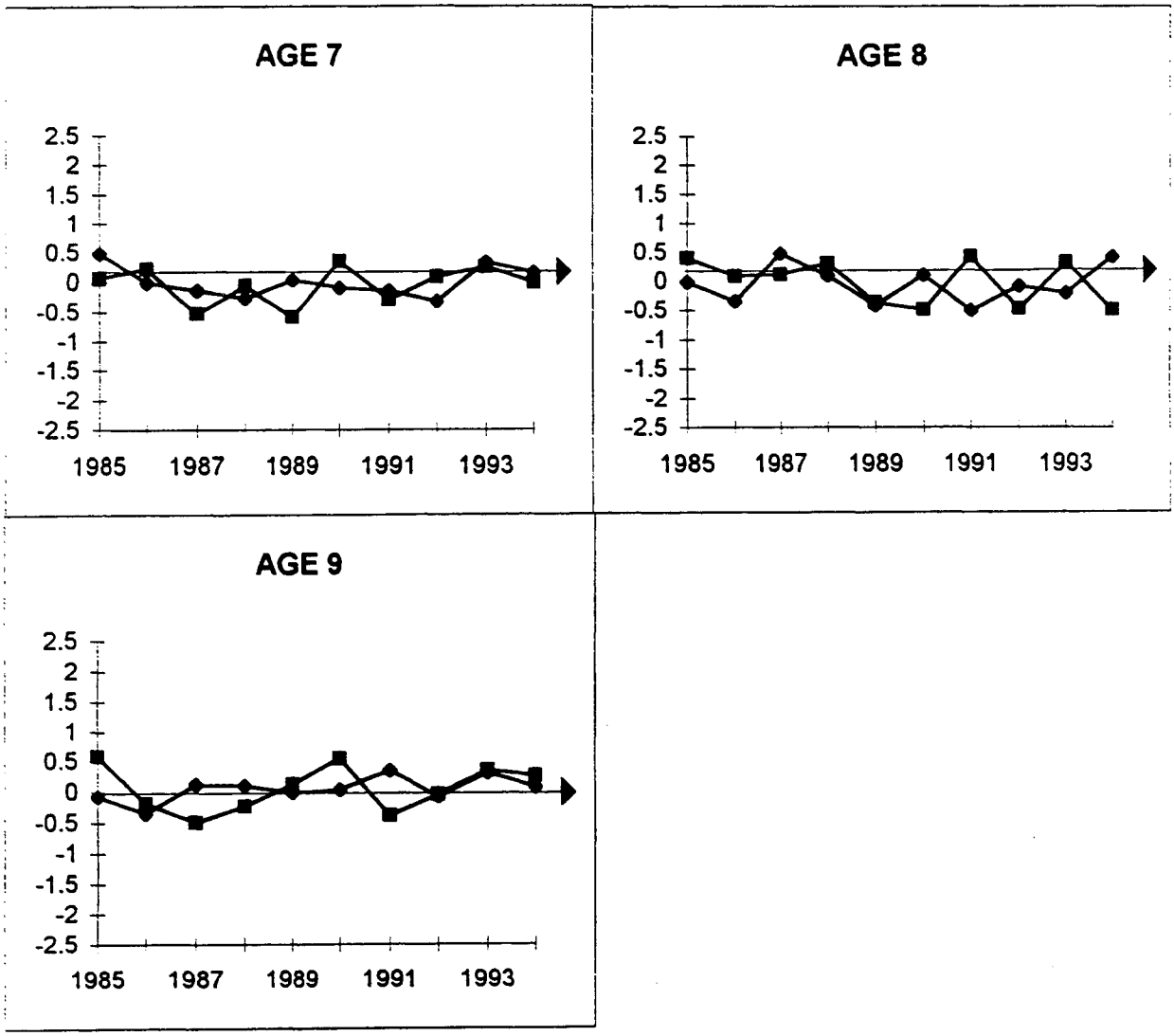
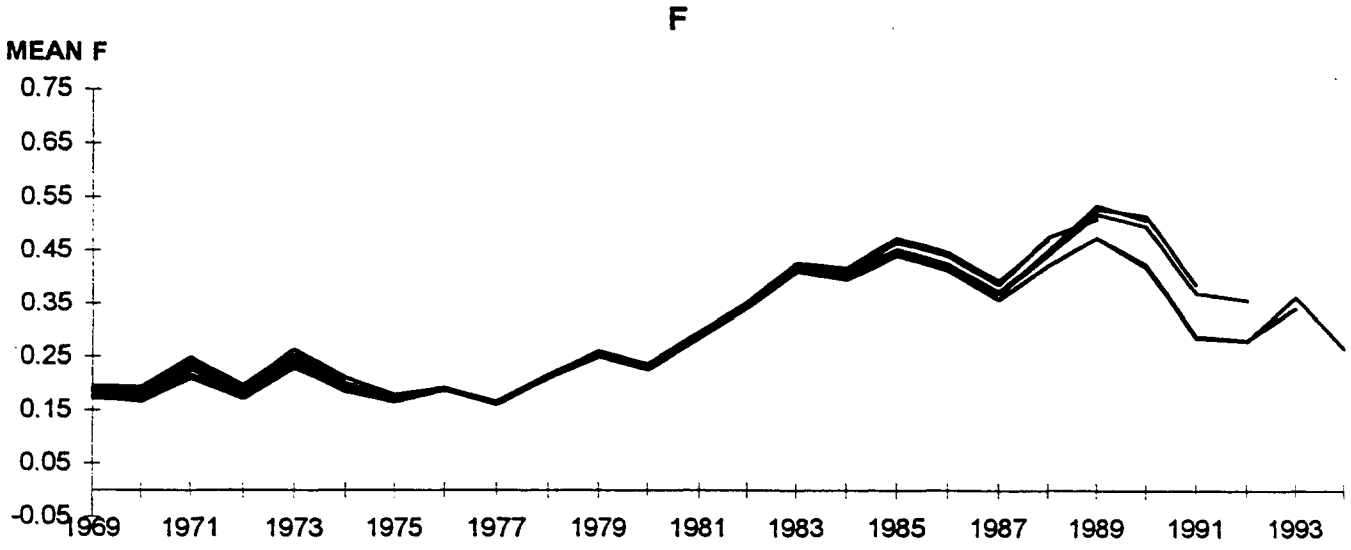
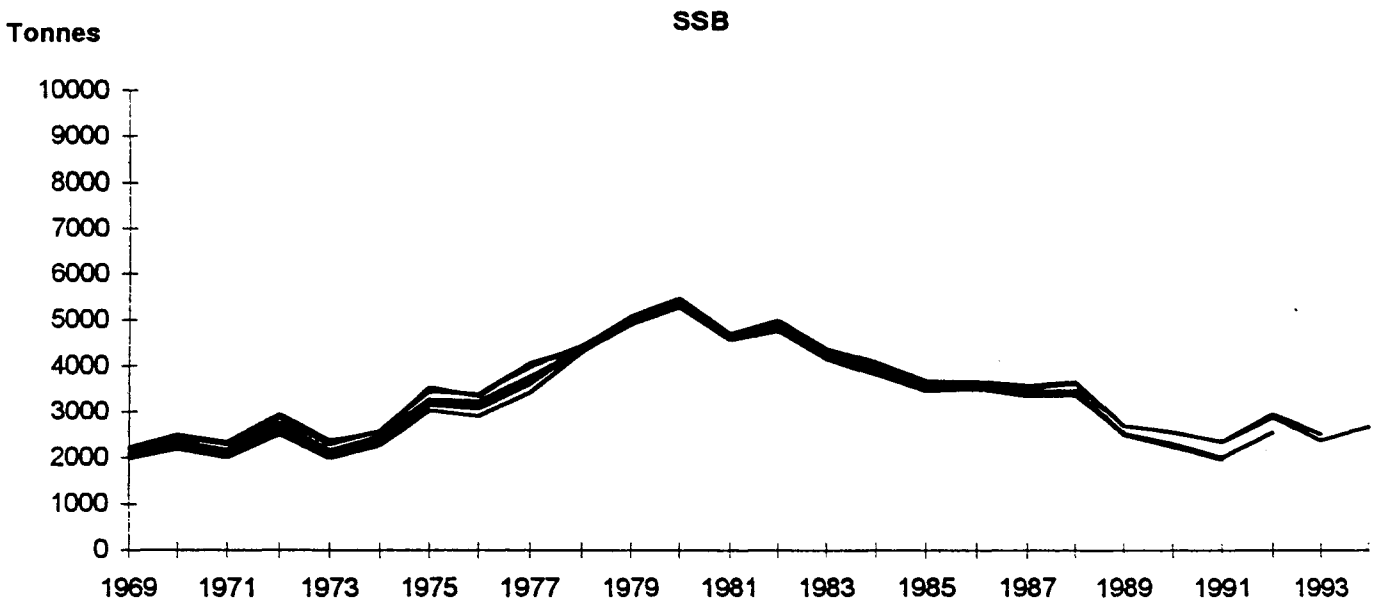


Figure 3.3.2 **VIIe SOLE RETROSPECTIVE XSA : qp=6 shr=0.5 rec=1-3**





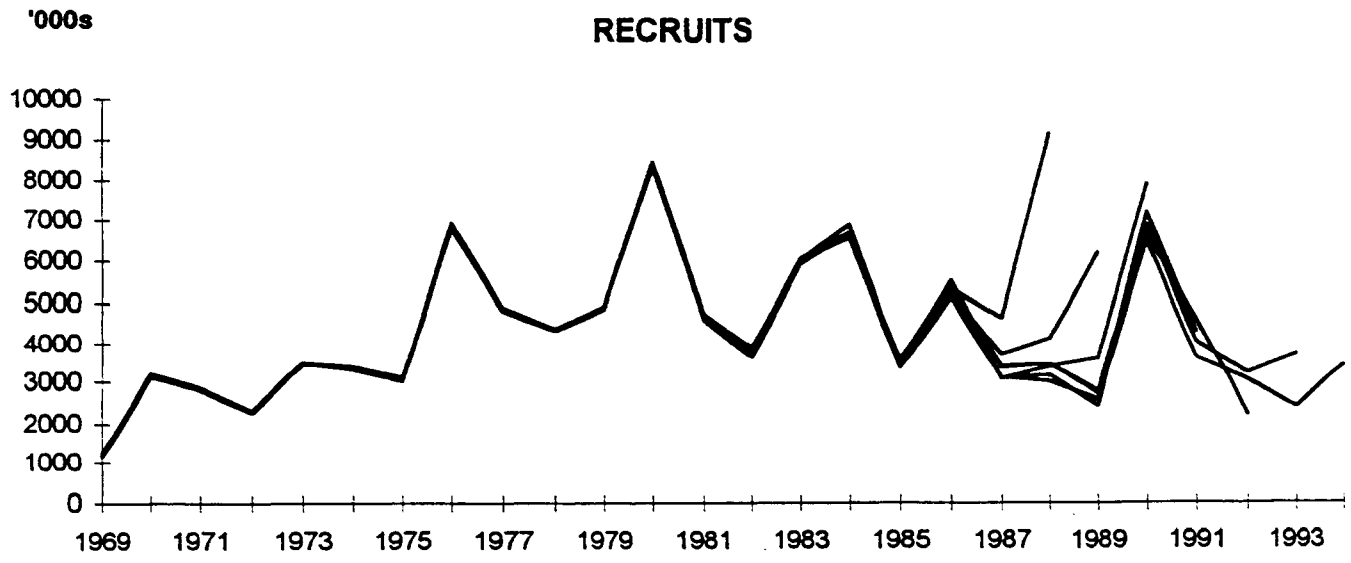
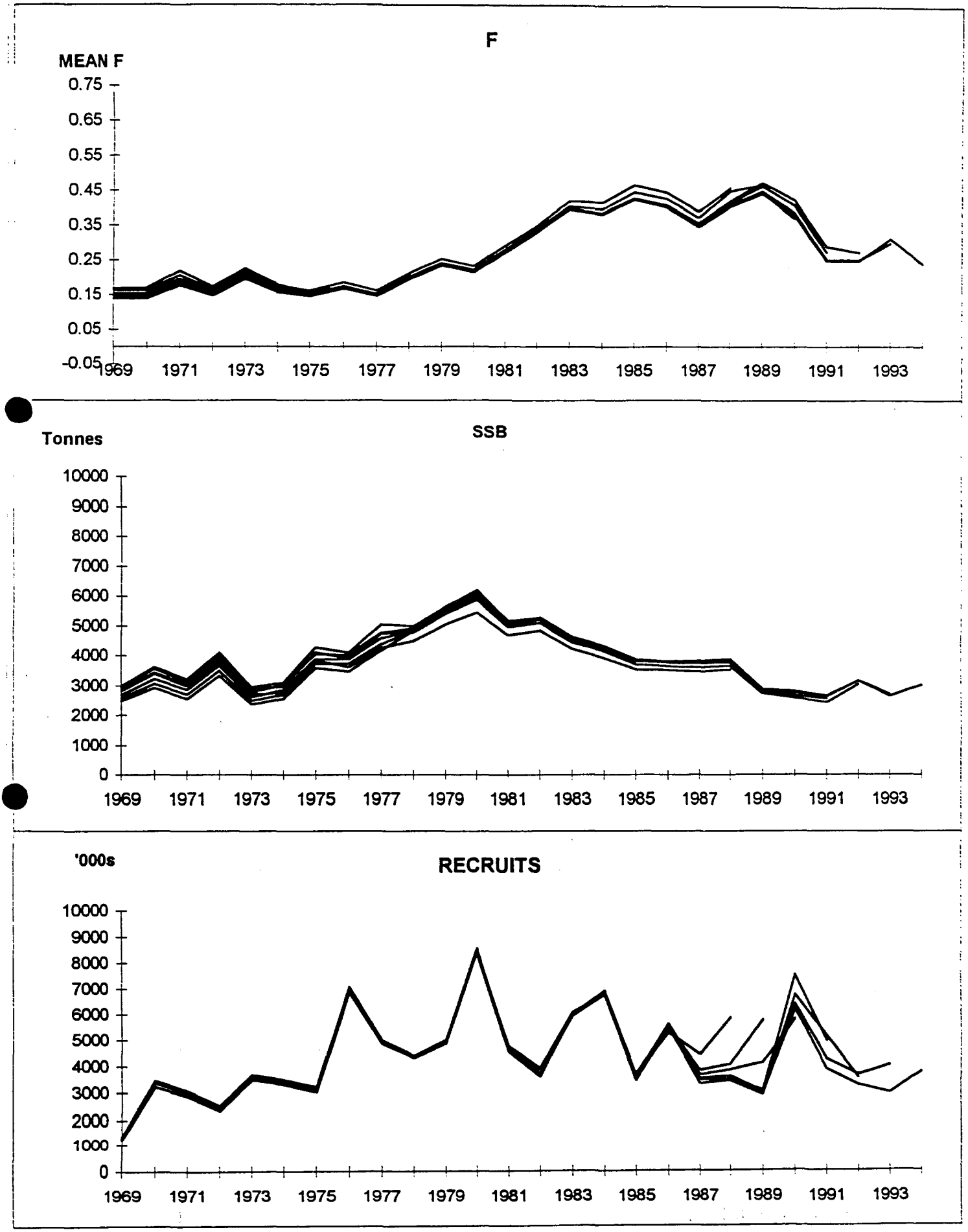


Figure 3.3.3 VIIe SOLE RETROSPECTIVE XSA : qp=7
shr=1.0
rec=1-6

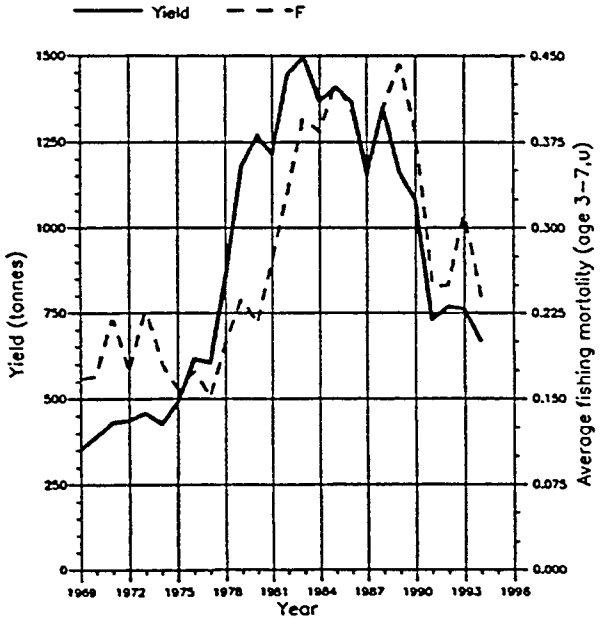


FISH STOCK SUMMARY

Figure 3.3.4 **STOCK: Sole in the Western English Channel (Fishing Area VIIe)**

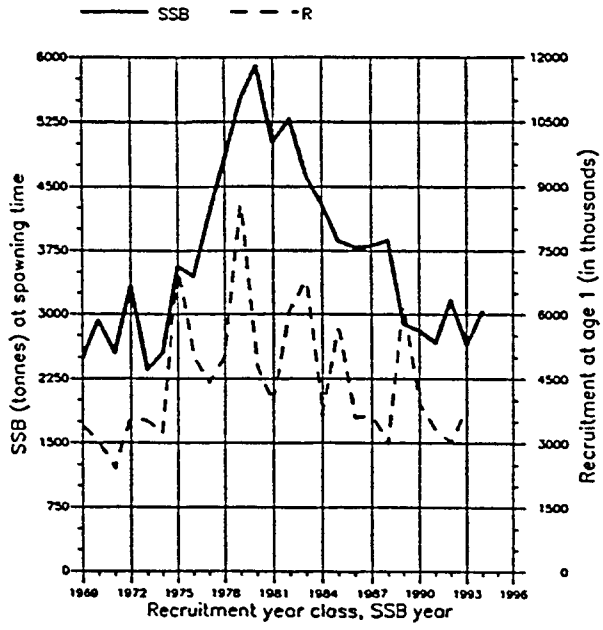
9–9–1995

Trends in yield and fishing mortality (F)



(run: XSA95FIN) **A**

Trends in spawning stock biomass (SSB) and recruitment (R)



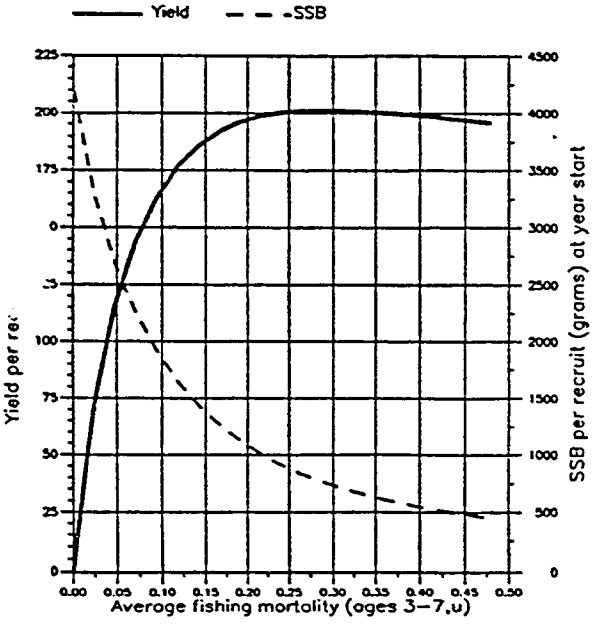
(run: XSA95FIN) **B**

FISH STOCK SUMMARY

STOCK: Sole in the Western English Channel (Fishing Area VIIe)

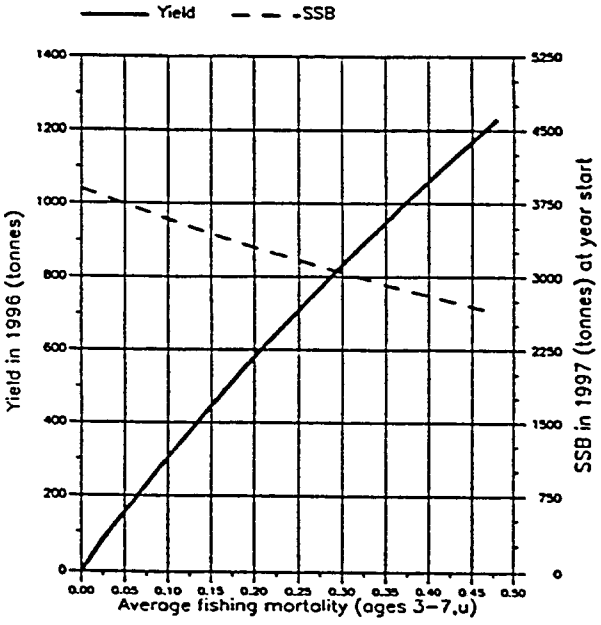
9–9–1995

Long term yield and spawning stock biomass



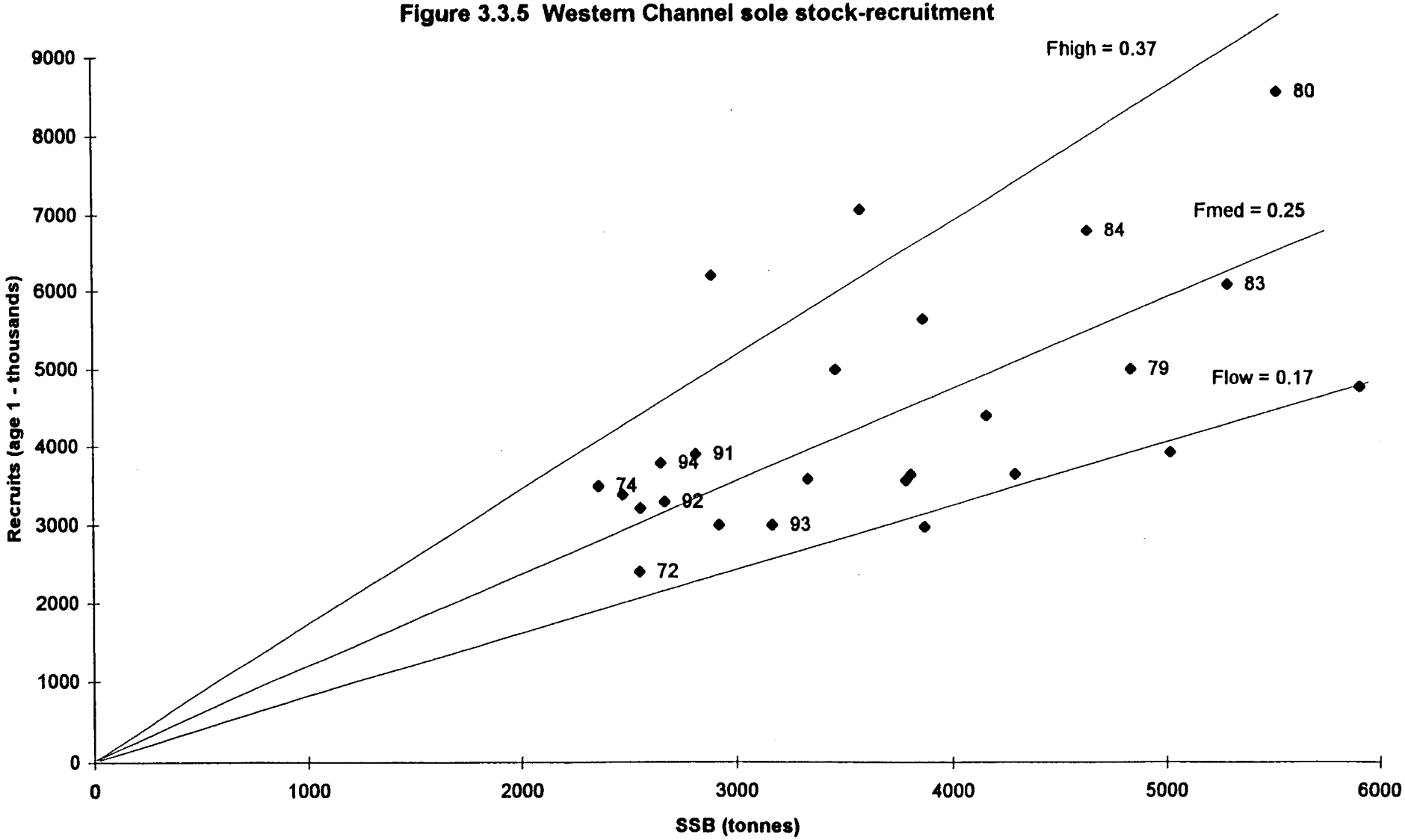
(run: YPR95) **C**

Short-term yield and spawning stock biomass



(run: PREDMO95) **D**

Figure 3.3.5 Western Channel sole stock-recruitment



3.4 Plaice in the Western Channel (Division VIIe)

3.4.1 Landings trends

National landings data reported to ICES, and Working Group estimates of total landings, are given in Table 3.4.1. There were no revisions to landings for 1993.

Estimated total international landings in 1994 were 1156t, 18% below 1993 landings, and 26 % below the value predicted by last year's assessment (1562t). Landings increased during the latter half of the 1980s, when the stock benefited from a series of good recruitments in 1986, 1987 and 1988. Landings have recently returned to the level of the early 1980s.

UK vessels were subject to monthly landings quotas throughout 1994, but vessels belonging to other nations fishing for plaice were unrestricted during 1994. There is no separate TAC for this stock, but a combined one for VIId and VIIe (9100T in 1994);.

3.4.2 Commercial catch-effort data and research vessel surveys

Effort and CPUE data sets for Division VIIe were available for UK beam and otter trawl fleets, fishing in Northern, Western and Southern sectors of VIIe; and a UK autumn survey, using twin 4m beam trawls from a chartered commercial vessel (Table 3.4.2).

Both otter trawl CPUE series have declined considerably since the peak in 1988. In 1994, CPUE was 5 % higher for the West sector, and 18 % lower for the North sector, than in 1993. Beam trawl CPUE declined in the North, West and South sectors, by 17 %, 25 % and 10 % respectively, compared to 1993. CPUE given by the survey has declined since the peak in 1988, and in 1994 was at a new low for the series, at 82% of the 1993 level. Overall reported effort (GRT-corrected) has remained around the 1992-1993 level for the otter-trawl fleet, but increased by over 20 % for the beam-trawl fleet.

3.4.3 Age and length compositions and mean weights at age

1993 age compositions were unchanged.

Quarterly age compositions for 1994 were available only from UK landings, and these together accounted for 86% of total international landings. The total international age composition was obtained by combining the UK age composition (including Channel Isles landings) with the French age composition, and raising the resulting age data set to include the French and Belgian landings. The SOP discrepancy for the total international age composition was less than 1%. Catch numbers at age are given in Table 3.4.3.

Using the same procedure as in previous years, total international catch and stock weights at age for 1994 were calculated as the weighted mean of the annual weight at age data supplied (weighted by catch numbers), and smoothed using a quadratic fit :

$$Wt = 0.1394+(0.0528*Age)+(0.003*(Age**2))$$

where catch weights at age are mid-year values (age = 1.5, 2.5 etc), and stock weights at age are 1 January values (age = 1.0, 2.0 etc). Catch weights at age have been scaled to give a SOP of 100%, and the same scaling has been applied to stock weights at age. Catch and stock weights at age are given in Tables 3.4.4 and 3.4.5.

3.4.4 Natural mortality and maturity at age

As in earlier assessments, natural mortality was assumed constant over ages and years at 0.12. The maturity ogive used (as derived for Irish Sea plaice) was the same as in previous assessments and is given in Table 3.4.11.

Prior to last year's assessment of this stock, the proportions of F and M before spawning were taken to be the same as those for Celtic Sea plaice (0.2 for both). However, spawning of plaice in VIIe takes place between December and March, with egg production reaching a peak in late January, and the proportions of F and M before spawning have both been set to zero for assessments made last year and at this meeting.

3.4.5 Estimation of Fishing Mortality

See section 1.5.1 for the general approach adopted at the WG. The age range for the analysis was 1-10+, as in earlier assessments.

For catch data screening, a separable VPA was carried out using a reference age of 4, F of 0.7 and S set to 0.8. The results (in ICES stock files) show no unusual patterns of residuals, though the high residuals on ages 2 and 3 in 1988-90 remain.

Last year, the UK commercial fleet tuning data sets were revised, using the UK length samples to process otter trawl and beam trawl length data separately to give two independent fleet data sets. These length data were converted to age using an all gears ALK. These fleet tuning data sets, which reflect effort in VIIe in total rather than just in one sector, are given in Table 3.4.6, along with the beam trawl survey data.

L/S runs were carried out on data from each fleet individually to screen the tuning data for catchability trends and exceptional residuals. For these runs, fishing mortalities at age 9 were calculated as 0.8 of the mean F on ages 6-8, with tricubic weighting over

the mean F on ages 6-8, with tricubic weighting over 20 years, as in previous assessments. The results (in ICES stock files) show no consistent trends, but, as noted in earlier assessments, there is evidence of lower catchabilities on most ages in the beam trawl data in 1988. Despite this anomaly, the new tuning data sets have improved the pattern of residuals. As last year, survey data for ages 6 and older were excluded from the remaining tuning runs.

Last year the selected XSA parameters were: catchability independent of stock size for ages 2 and older (i.e. age 1 treated as recruits), q plateau set to ages 7 and older, and an F shrinkage of 0.3 was considered necessary to avoid retrospective bias.

Several series of XSA runs were carried out to review the parameters for the current assessment. In the first series, the ages treated as recruits were 1 (as last year); 1 and 2; and 1, 2 and 3 and 1,2,3 and 4 respectively. All four runs gave similar estimates of survivors, SSB and fishing mortalities (results in ICES files). The run treating age 1-3 as recruits gave the best overall fit (based on standard error comparisons and fleet contributions to survivors estimates), and this was accepted.

Examination of the XSA diagnostics confirmed that a q plateau at age 7, as tested and chosen last year, was appropriate.

Adjusting the tricubic taper range from 20 to 15 or 10 years had little effect on the results, so 20 years was used, as last year.

In earlier assessments, a shrinkage SE of 0.3 was chosen to avoid retrospective bias in fishing mortality estimates. For this assessment, retrospective XSA runs were also carried out using shrinkage values of 0.5, 0.8 and 1.1; Figures 3.4.1a, b and c. These show that reducing the shrinkage results in very little change in the patterns of F and SSB, which are respectively elevated and depressed in 1994, though retrospective bias in estimates of recruits increases with shrinkage. In view of the increasing trend in F for this stock, it was therefore decided to use a shrinkage of 0.8 in the final run.

Table 3.4.7 presents the full diagnostics for the final run accepted by the WG (ages 1-3 treated as recruits, q plateau at age 7, F shrinkage of 0.8). The UK beam trawl survey contributes strongly to the estimates of survivors for the 3 youngest ages, and estimates for the older ages are higher from the beam-trawl fleet than those from the other two fleets. Nevertheless, SEs of survivor estimates from all three fleets are reasonable and consistent for ages 4 and older. The plots of fleet catchabilities at age are shown in Figure 3.4.2.

3.4.6 VPA results

Fishing mortalities and population numbers from the final run are given in Tables 3.4.8 and 9, and a full summary of VPA results is given in Table 3.4.10, and Figures 3.4.3A & B.

Spawning stock biomass (SSB) was stable during the period 1981-1987, increased to a higher level during 1988-1990 following good recruitments in the mid-1980s, and has recently declined to the level observed in 1979/80. The 1994 SSB is estimated to be 33 % below the average for the series. Fishing mortality has increased throughout the time series and remained at a high level for the last five years. A succession of below-average recruitments since 1988 has contributed to the declining yield and SSB.

3.4.7 Yield per recruit and catch forecasts

All available VIIe plaice recruitment information is already incorporated into the assessment via the tuning fleets, so RCT3 analyses are not required.

The 1992 year class is estimated to have been 3.3 million 1 year-olds, 35 % below the GM(1976-92) value of 5.1 millions.

The 1993 year class is estimated equally by he survey and shrinkage in XSA to have been 4.6 million 1 year-olds. This is 10% below the GM, and the VPA estimate was accepted.

1994 and subsequent year classes are taken as GM in the predictions.

Input values for the yield per recruit and catch forecast are given in Table 3.4.11. Stock numbers were obtained from the VPA values for ages 2 and above, and GM recruitment at age 1. The F at age vector was the mean of the period 1992 -1994, scaled to the F94. Catch and stock weights at age were the mean for the period 1992 -1994.

Results for yield and SSB per recruit, conditional on the recent exploitation pattern, are given in Table 3.4.13 and Figure 3.4.3C. Fmax is given by a reference F of 0.29, 37% of F94, which is similar to last year's result (0.25). Long term yield and SSB (at current F and assuming GM recruitment) are given as 1350t and 1700t respectively.

Table 3.4.13 gives the management option table, and the short term yield and SSB trajectories are shown in Figure 3.4.3D. Assuming status quo F in 1995, leads to a catch of 1200 t, from an SSB at the start of the year of 1600 t. Continuing at the same level for 1996 implies an SSB of 1500 t and a catch of 1200 t, with SSB of 1600 t at the start of 1997. Detailed results for 1995, 1996 and 1997 (by age group) are given in

Table 3.4.14. Table 3.4.15 shows the percentage contributions of recent year-classes to the forecast catches and SSBs. The 1994 and 1995 year-classes are assumes GM and are predicted to represent 17% and 46% of the catch in 1996 and SSB in 1997, respectively.

The stock-recruit relationship is shown in Figure 3.4.4, where it appears that, for this time series, high recruitments are associated with average SSBs. Fhigh was estimated to be 1.17, Fmed 0.62 and Flow 0.28. F94 is estimated to be 26% above Fmed.

3.4.8 Comments on the assessment

Sampling data for this stock are considered reasonable, and there are no age reading difficulties. Under-reporting and misreporting of catches by ICES Division may have taken place in the most recent years, but no information is available on the magnitude of the problem. The inclusion of survey data in the tuning analysis adds resilience to the assessment, and its contribution to estimates of recruiting year classes has reduced the reliance on GM assumptions in the predictions. This year's assessment has resulted in a considerable upward revision in the estimate of fishing mortality in recent years, but varying the XSA run options for shrinkage (level and age range), taper period, recruiting age and plus group, has very little effect on this result.

3.4.9 Management considerations

Effort has increased throughout the assessment period and is currently near its highest level.

SSB has decreased sharply since 1990 and is approaching historical low levels, near which it is expected to remain during 1996-1997.

There is some indication of reduced recruitment at low SSB levels.

Table 3.4.1 English Channel PLAICE. Nominal landings (tonnes) in Division VIIe, 1976-1993, as used by the Working Group.

Year	Belgium	Denmark	France	UK (Engl. & Wales)	Others	Total reported	Unallocated[2]	Total as used by WG
1976	5	-[1]	323	312	-	640	-	640
1977	3	-[1]	336	363	-	702	-	702
1978	3	-[1]	314	467	-	78	-	784
1979	2	-[1]	458	515	-	975	2	977
1980	23	-[1]	325	609	9	966	113	1,079
1981	27	-	537	953	-	1,517	-16	1,501
1982	81	-	363	1,109	-	1,553	135	1,688
1983	20	-	371	1,195	-	1,586	-91	1,495
1984	24	-	278	1,144	-	1,446	101	1,547
1985	39	-	197	1,122	-	1,358	83	1,441
1986	26	-	276	1,389	-[1]	1,691	119	1,810
1987	68	-	435	1,419	-	1,922	36	1,958
1988	90	-	584	1,654	-	2,328	130	2,458
1989	89	-	448[2]	1,708	2	2,247	111	2,358
1990	82	2	N/A[3]	1,873	18	1,975	618	2,593
1991	57	-	251[2]	1,314	16	1,638	210	1,848
1992	25	-	277[2]	1,110	19	1,431	193	1,624
1993	56	-	279[2]	1,079	4	1,417	-	1,417
1994	10	-	148[2]	996	3	1,156	-	1,156

[1]Included in Division VIId.
[2]Estimated by the Working Group.
[3]Divisions VIId,e = 14,739 t.

Table 3.4.2 Division VIIe PLAICE CPUE and effort data. UK (E+W) >40' vessels, corrected for fishing power. Also autumn beam trawl survey CPUE.

(CPUE kg/hr).						(CPUE kg/10 km)
Year	West Sector		North Sector		South Sector	
	Otter	Beam	Otter	Beam	Beam	Survey
1972	2.31	-	4.50	-	-	-
1973	2.25	-	3.85	-	-	-
1974	1.65	-	3.47	-	-	-
1975	1.78	-	3.53	-	-	-
1976	1.89	-	3.62	-	-	-
1977	1.37	-	3.10	-	-	-
1978	1.61	5.41	3.63	10.35	11.84	-
1979	1.84	4.16	4.58	7.37	6.58	-
1980	2.02	3.15	5.82	6.06	6.45	-
1981	2.61	4.44	10.98	8.35	8.33	-
1982	3.28	4.43	10.77	9.23	7.69	-
1983	2.57	2.76	11.03	9.64	5.71	-
1984	2.95	4.08	10.92	10.38	7.80	-
1985	2.60	3.79	8.81	9.00	6.38	15.21
1986	3.25	.30	10.94	12.21	6.85	16.46
1987	3.56	5.37	11.02	9.69	7.45	20.59
1988	3.90	3.50	15.38	6.51	4.85	25.34
1989	2.69	6.50	10.87	14.25	6.88	14.80
1990	2.95	6.52	7.77	15.64	10.17	11.60
1991	2.80	6.16	5.08	13.24	7.47	8.73
1992	1.92	6.30	3.51	10.61	9.69	7.45
1993	1.39	6.14	3.03	11.04	7.17	6.20
1994	1.46	4.62	2.48	9.17	6.48	5.70

Effort (Effective hours fishing)					
Year	West Sector		North Sector		South Sector
	Otter	Beam	Otter	Beam	Beam
1972	40,290	-	24,312	-	-
1973	43,764	-	25,779	-	-
1974	30,560	-	17,967	-	-
1975	31,895	-	16,051	-	-
1976	32,936	-	22,771	-	-
1977	33,219	-	21,194	-	-
1978	31,741	3,996	16,823	10,353	7,739
1979	32,591	7,766	16,981	22,091	9,523
1980	36,033	11,792	13,647	38,212	12,154
1981	31,638	12,832	15,172	37,830	14,627
1982	24,090	22,548	14,422	42,281	14,765
1983	33,410	40,959	19,117	36,935	16,765
1984	36,869	36,892	15,800	27,046	25,171
1985	40,068	42,082	17,545	30,739	19,367
1986	28,757	34,143	20,758	25,373	16,815
1987	26,967	41,219	17,995	20,866	24,964
1988	35,589	44,972	17,366	28,166	30,222
1989	33,522	46,523	21,113	29,769	33,655
1990	32,220	41,495	20,605	34,635	24,817
1991	24,519	40,398	16,005	25,055	18,121
1992	22,760	29,114	16,840	35,190	16,561
1993	22,793	32,453	15,298	31,353	20,112
1994	22,824	37,812	14,864	32,626	29,941

Table 3.4.3 Plaice in the Western Channel (Division VIIe)

At 14/09/1995 8:02

Table 1 Catch numbers at age Numbers*10**-3

YEAR	1976	1977	1978	1979	1980	1981	1982	1983	1984
AGE									
1	25	6	46	20	19	41	72	3	77
2	106	621	242	519	743	657	273	708	920
3	620	304	914	697	712	1854	1710	698	1419
4	156	266	103	543	205	381	1131	1184	455
5	110	84	136	70	188	95	198	514	372
6	58	50	49	75	56	89	71	84	150
7	59	31	29	35	59	16	74	33	71
8	37	46	26	23	19	43	11	38	20
9	14	15	21	14	13	14	26	2	30
+gp	79	59	66	82	130	80	115	92	43
TOTALNUM	1264	1482	1632	2078	2144	3270	3681	3356	3557
TONSLAND	640	702	784	977	1079	1501	1688	1495	1547
SOPCOF %	100	100	100	100	100	100	100	100	100

Table 1 Catch numbers at age Numbers*10**-3

YEAR	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
AGE										
1	3	10	74	12	10	57	41	90	36	84
2	573	894	1029	1797	254	320	533	674	639	311
3	1228	2104	1846	4033	2520	2875	1020	1159	1256	1283
4	971	642	1103	731	2186	2233	1547	609	540	605
5	122	364	550	369	617	917	766	553	220	184
6	201	67	195	108	223	202	381	361	231	74
7	127	106	50	76	95	113	80	201	189	91
8	19	61	37	28	80	60	34	53	143	57
9	4	27	36	16	25	42	24	23	31	63
+gp	48	59	46	40	86	55	42	41	74	41
TOTALNUM	3296	4334	4966	7210	6096	6874	4468	3764	3359	2793
TONSLAND	1441	1810	1958	2458	2358	2593	1848	1624	1417	1156
SOPCOF %	100	100	100	100	100	100	100	100	100	100

Table 3.4.4 Plaice in the Western Channel (Division VIIe)

At 14/09/1995 8:02

Table 2 Catch weights at age (kg)

YEAR		1976	1977	1978	1979	1980	1981	1982	1983	1984
AGE										
	1	0.186	0.199	0.198	0.195	0.248	0.154	0.198	0.115	0.152
	2	0.285	0.305	0.302	0.299	0.337	0.287	0.291	0.241	0.267
	3	0.383	0.409	0.406	0.401	0.427	0.417	0.384	0.36	0.384
	4	0.479	0.512	0.508	0.502	0.518	0.543	0.477	0.471	0.5
	5	0.575	0.615	0.61	0.603	0.611	0.666	0.568	0.576	0.616
	6	0.669	0.716	0.71	0.702	0.705	0.785	0.66	0.672	0.732
	7	0.763	0.816	0.809	0.8	0.8	0.9	0.749	0.762	0.848
	8	0.855	0.915	0.908	0.897	0.897	1.013	0.839	0.845	0.964
	9	0.947	1.014	1.005	0.994	0.995	1.121	0.927	0.92	1.08
+gp		1.2839	1.3684	1.4027	1.3198	1.4026	1.4845	1.2985	1.1188	1.5563
SOPCOFAC		0.9993	1.0001	0.9999	1.0002	0.9998	1.0004	1.0005	1.0004	0.9997

Table 2 Catch weights at age (kg)

YEAR		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
AGE											
	1	0.107	0.181	0.257	0.143	0.168	0.248	0.206	0.25	0.214	0.218
	2	0.234	0.271	0.294	0.229	0.234	0.28	0.261	0.291	0.271	0.28
	3	0.358	0.365	0.344	0.323	0.308	0.323	0.326	0.346	0.335	0.349
	4	0.477	0.462	0.411	0.426	0.388	0.377	0.401	0.414	0.408	0.423
	5	0.593	0.563	0.49	0.538	0.475	0.442	0.485	0.497	0.488	0.503
	6	0.704	0.667	0.584	0.66	0.57	0.518	0.58	0.593	0.576	0.588
	7	0.812	0.775	0.693	0.79	0.671	0.606	0.684	0.703	0.672	0.68
	8	0.914	0.887	0.816	0.929	0.78	0.704	0.798	0.826	0.775	0.777
	9	1.014	1.003	0.953	1.077	0.896	0.814	0.921	0.964	0.887	0.88
+gp		1.3693	1.5072	1.4175	1.4485	1.2106	1.1323	1.2986	1.3608	1.2113	1.2102
SOPCOFAC		0.9998	0.9997	1.0002	0.9999	0.9999	1.0006	0.9982	1.0002	0.9998	0.9997

Table 3.4.5 Plaice in the Western Channel (Division VIIe)

At 14/09/1995 8:02

Table 3 Stock weights at age (kg)

YEAR	1976	1977	1978	1979	1980	1981	1982	1983	1984
AGE									
1	0.109	0.116	0.115	0.114	0.114	0.126	0.108	0.116	0.111
2	0.215	0.23	0.228	0.226	0.227	0.25	0.214	0.228	0.222
3	0.32	0.342	0.339	0.335	0.338	0.373	0.318	0.335	0.334
4	0.422	0.452	0.448	0.443	0.447	0.492	0.419	0.436	0.446
5	0.524	0.56	0.556	0.549	0.554	0.609	0.517	0.532	0.56
6	0.622	0.666	0.66	0.653	0.66	0.725	0.615	0.623	0.673
7	0.719	0.77	0.763	0.755	0.764	0.838	0.71	0.71	0.788
8	0.814	0.872	0.864	0.854	0.867	0.949	0.802	0.791	0.903
9	0.908	0.972	0.963	0.953	0.967	1.057	0.893	0.867	1.018
+gp	1.2411	1.3225	1.3555	1.2748	1.3511	1.4355	1.2549	1.094	1.4984

Table 3 Stock weights at age (kg)

YEAR	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
AGE										
1	0.112	0.096	0.068	0.103	0.138	0.236	0.182	0.235	0.188	0.188
2	0.222	0.195	0.145	0.184	0.2	0.262	0.232	0.269	0.241	0.248
3	0.331	0.297	0.232	0.275	0.27	0.3	0.292	0.317	0.302	0.314
4	0.438	0.401	0.326	0.373	0.347	0.349	0.362	0.378	0.371	0.385
5	0.543	0.507	0.429	0.481	0.431	0.408	0.442	0.454	0.447	0.462
6	0.647	0.615	0.539	0.598	0.522	0.479	0.531	0.543	0.531	0.545
7	0.749	0.727	0.659	0.723	0.62	0.561	0.631	0.646	0.623	0.633
8	0.849	0.84	0.788	0.858	0.725	0.654	0.74	0.763	0.723	0.728
9	0.948	0.955	0.924	1.002	0.837	0.758	0.858	0.893	0.83	0.828
+gp	1.3287	1.4415	1.3475	1.3633	1.1432	1.0635	1.2229	1.2742	1.1447	1.1498

Table 3.4.6

FLT10: VIIE B/Trawl Survey

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5
1986	147.68	91	128	249	95	35
1987	134.34	536	148	140	73	37
1988	128.23	139	371	340	97	22
1989	165.66	31	70	281	188	23
1990	176.04	25	38	220	87	75
1991	171.59	22	27	63	79	62
1992	196.60	152	44	72	24	40
1993	188.26	21	70	60	24	13
1994	205.87	34	32	98	30	10

FLT11: UK(E+W)Otter trawl

Year	Fishing effort	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12	Catch, age 13	Catch, age 14
1984	52886	161	293	97	81	28	12	3	6	1	1	1	0	0
1985	57685	125	258	194	23	32	15	2	1	2	0	1	0	0
1986	49521	191	427	130	50	9	15	7	4	1	1	0	1	0
1987	45112	194	381	223	100	25	6	3	5	3	0	0	0	0
1988	53402	392	754	117	52	15	10	3	2	3	0	0	0	1
1989	54707	43	494	360	77	26	7	6	1	4	1	0	0	0
1990	53050	22	347	266	85	18	11	6	3	2	1	0	0	0
1991	40789	28	89	135	65	30	6	3	2	1	0	1	0	0
1992	39909	26	72	46	40	25	13	4	1	1	1	0	0	0
1993	39240	40	76	33	12	12	10	8	2	1	1	1	0	0
1994	38754	23	86	37	10	3	4	2	3	0	0	0	0	0

FLT12: UK(E+W)Beam trawl

Year	Fishing effort	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12	Catch, age 13	Catch, age 14
1984	87631	337	511	149	130	58	25	8	10	2	3	1	2	2
1985	92188	218	461	360	45	65	46	7	2	5	1	2	2	1
1986	76331	241	656	228	117	24	39	20	11	3	5	1	3	3
1987	87049	308	493	305	176	82	22	20	15	10	4	3	1	1
1988	103360	229	825	197	118	34	26	10	6	9	1	1	1	2
1989	109947	94	923	785	210	97	49	35	7	16	10	3	1	2
1990	100947	104	1054	827	327	77	54	23	13	12	7	3	1	1
1991	83574	158	366	641	356	160	36	11	8	4	2	4	1	1
1992	80865	147	466	308	294	172	89	26	10	5	5	2	1	0
1993	83918	317	544	248	103	115	90	67	14	12	7	6	1	2
1994	100379	161	659	313	104	43	53	35	38	10	4	4	4	1

Table 3.4.7

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   9-Sep-95  09:48:27

Extended Survivors Analysis

Plaice in VIIe (run: XSA95/X95)

CPUE data from file /users/fish/ifad/ifapwork/wgssds/ple_echw/FLEET.X95

Catch data for  19 years. 1976 to 1994. Ages  1 to  10.

     Fleet,           First, Last, First, Last, Alpha,  Beta
                       year, year,  age ,  age
FLT10: VIIE B/Trawl ,  1986, 1994,   1,     5,   .750,   .800
FLT11: UK(E+W)Otter ,  1984, 1994,   2,     9,   .000,  1.000
FLT12: UK(E+W)Beam t,  1984, 1994,   2,     9,   .000,  1.000


Time series weights :

     Tapered time weighting applied
     Power =    3 over  20 years


Catchability analysis :

     Catchability dependent on stock size for ages <    4

        Regression type = C
        Minimum of   5 points used for regression
        Survivor estimates shrunk to the population mean for ages <  4


     Catchability independent of age for ages >=    7


Terminal population estimation :

     Survivor estimates shrunk towards the mean F
     of the final   5 years or the   4 oldest ages.

     S.E. of the mean to which the estimates  are shrunk =    .800

     Minimum standard error for population
     estimates derived from each fleet =    .300

     Prior weighting not applied


Tuning converged after   28 iterations
```

Table 3.4.7 (cont'd.)

Regression weights

,	.751,	.820,	.877,	.921,	.954,	.976,	.990,	.997,	1.000, 1.000

Fishing mortalities

Age,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994
1,	.000,	.001,	.007,	.002,	.003,	.017,	.011,	.020,	.012,	.020
2,	.107,	.176,	.096,	.203,	.037,	.122,	.198,	.229,	.178,	.121
3,	.488,	.634,	.597,	.588,	.441,	.658,	.629,	.767,	.776,	.584
4,	.664,	.464,	.741,	.453,	.672,	.807,	.832,	.891,	.931,	1.014
5,	.411,	.509,	.844,	.534,	.789,	.604,	.653,	.741,	.880,	.893
6,	.638,	.378,	.512,	.348,	.656,	.586,	.491,	.673,	.727,	.766
7,	.527,	.757,	.489,	.348,	.532,	.754,	.439,	.474,	.837,	.644
8,	.247,	.471,	.590,	.507,	.680,	.693,	.482,	.531,	.666,	.589
9,	.343,	.594,	.511,	.498,	1.094,	.860,	.599,	.638,	.620,	.635

XSA population numbers (Thousands)

	AGE							
YEAR ,	1,	2,	3,	4,	5,	6,	7,	8,
1985 ,	6.62E+03,	5.97E+03,	3.37E+03,	2.12E+03,	3.84E+02,	4.52E+02,	3.29E+02,	9.23E+01, 1.46E+01,
1986 ,	1.35E+04,	5.87E+03,	4.76E+03,	1.84E+03,	9.69E+02,	2.26E+02,	2.12E+02,	1.72E+02, 6.40E+01,
1987 ,	1.18E+04,	1.20E+04,	4.36E+03,	2.24E+03,	1.02E+03,	5.17E+02,	1.37E+02,	8.81E+01, 9.55E+01,
1988 ,	8.37E+03,	1.04E+04,	9.63E+03,	2.13E+03,	9.47E+02,	3.90E+02,	2.75E+02,	7.47E+01, 4.33E+01,
1989 ,	3.34E+03,	7.41E+03,	7.50E+03,	4.74E+03,	1.20E+03,	4.92E+02,	2.45E+02,	1.72E+02, 3.99E+01,
1990 ,	3.62E+03,	2.96E+03,	6.33E+03,	4.28E+03,	2.15E+03,	4.84E+02,	2.26E+02,	1.27E+02, 7.73E+01,
1991 ,	3.99E+03,	3.16E+03,	2.32E+03,	2.91E+03,	1.70E+03,	1.04E+03,	2.39E+02,	9.45E+01, 5.65E+01,
1992 ,	4.78E+03,	3.50E+03,	2.30E+03,	1.10E+03,	1.12E+03,	7.82E+02,	5.66E+02,	1.37E+02, 5.18E+01,
1993 ,	3.31E+03,	4.15E+03,	2.47E+03,	9.46E+02,	3.99E+02,	4.75E+02,	3.54E+02,	3.12E+02, 7.12E+01,
1994 ,	4.62E+03,	2.90E+03,	3.08E+03,	1.01E+03,	3.31E+02,	1.47E+02,	2.04E+02,	1.36E+02, 1.42E+02,

Estimated population abundance at 1st Jan 1995

, .00E+00, 4.01E+03, 2.28E+03, 1.52E+03, 3.24E+02, 1.20E+02, 6.06E+01, 9.48E+01, 6.69E+01,

Taper weighted geometric mean of the VPA populations:

, 5.38E+03, 4.77E+03, 3.72E+03, 1.79E+03, 8.02E+02, 3.97E+02, 2.18E+02, 1.08E+02, 5.16E+01,

Standard error of the weighted Log(VPA populations) :

, .4778, .5067, .5377, .6238, .6493, .6009, .5675, .6253, .7447,

Table 3.4.7 (cont'd.)

Log catchability residuals.

Fleet : FLT10: VIIE B/Trawl Survey

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	99.99	-.63	.49	.14	.13	-.09	-.24	.53	-.13	-.25
2	99.99	.30	-.30	.49	-.45	.10	-.13	.00	.12	-.09
3	99.99	.40	.11	.01	-.16	-.09	-.02	.07	-.10	-.14
4	99.99	.41	.26	.42	.19	-.43	-.09	-.40	-.18	-.05
5	99.99	.12	.47	-.16	-.41	-.02	.09	.00	.06	-.10
6	No data for this fleet at this age									
7	No data for this fleet at this age									
8	No data for this fleet at this age									
9	No data for this fleet at this age									

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	4	5
Mean Log q	-7.9183	-7.9464
S.E(Log q)	.3226	.2351

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	.53	1.762	9.08	.68	9	.39	-9.53
2	.62	1.874	8.92	.79	9	.31	-9.18
3	.75	2.081	8.04	.91	9	.18	-7.95

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
4	.92	.402	7.89	.81	9	.32	-7.92
5	.99	.064	7.94	.88	9	.25	-7.95

Table 3.4.7 (cont'd.)

Fleet : FLT11: UK(E+W)Otter

Age	1984
1	No data for this fleet at this age
2	.57
3	.14
4	.46
5	.45
6	.13
7	.51
8	.80
9	.59

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	No data for this fleet at this age									
2	.09	.50	-.17	.34	-.78	-.24	.04	-.09	.00	.01
3	.13	.32	.38	-.04	-.17	-.17	.01	-.07	-.09	-.27
4	.19	.00	.56	-.33	.06	-.05	-.07	-.12	-.27	-.18
5	-.11	-.07	.81	-.07	.17	-.36	-.11	-.12	-.21	-.19
6	.47	-.07	.28	-.20	.24	-.12	-.15	.06	-.14	-.32
7	.03	.72	.21	-.20	-.38	.28	-.26	-.31	.07	-.36
8	-.84	.04	.01	-.03	-.12	.22	-.01	-.04	-.10	-.68
9	.35	.53	.41	.11	-.28	.10	.15	-.41	-.03	-.30

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	4	5	6	7	8	9
Mean Log q	-13.1797	-13.4105	-13.7230	-13.7736	-13.7736	-13.7736
S.E(Log q)	.2747	.3323	.2357	.3647	.4091	.3466

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	.63	1.440	12.58	.66	11	.39	-14.97
3	.74	1.774	12.05	.86	11	.22	-13.35

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
4	.94	.368	12.86	.84	11	.27	-13.18
5	.95	.265	13.10	.80	11	.33	-13.41
6	.88	.998	12.77	.89	11	.21	-13.72
7	1.61	-1.220	18.78	.34	11	.57	-13.77
8	1.35	-1.034	17.07	.52	11	.54	-13.85
9	1.06	-.285	14.30	.72	11	.38	-13.69

Table 3.4.7 (cont'd.)

Fleet : FLT12: UK(E+W)Beam t

Age	1984
1	No data for this fleet at this age
2	2.49
3	-.51
4	-.09
5	-.24
6	-.46
7	-.21
8	.34
9	-.34

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	No data for this fleet at this age									
2	.24	1.45	1.02	-.39	-3.89	-2.13	.20	.01	2.47	-.46
3	-.82	.62	-.57	-.36	-.16	.94	-.65	.34	.63	.20
4	-.14	-.35	-.27	-.95	-.33	-.04	.29	.59	.50	.53
5	-.57	-.31	.06	-.57	-.18	-.31	.22	.51	.52	.54
6	-.11	-.34	-.01	-.86	.04	-.12	-.01	.46	.54	.57
7	-.26	.30	-.08	-.85	-.07	.28	-.13	-.03	.57	.33
8	-1.00	-.28	.31	-.43	.01	-.02	-.37	.18	.32	.29
9	-.36	.17	-.09	-.40	.03	-.02	-.12	.24	.22	.35

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	4	5	6	7	8	9
Mean Log q	-12.7018	-12.7521	-12.9047	-12.8326	-12.8326	-12.8326
S.E(Log q)	.4841	.4302	.4447	.3882	.4095	.2579

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	3.72	-2.048	31.04	.07	11	2.01	-14.56
3	2.94	-4.555	22.04	.41	11	.64	-12.97

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
4	1.68	-1.641	16.23	.42	11	.75	-12.70
5	1.25	-.863	14.26	.59	11	.55	-12.75
6	1.05	-.153	13.22	.58	11	.49	-12.90
7	1.00	.004	12.82	.49	11	.41	-12.83
8	.86	.617	11.73	.70	11	.36	-12.88
9	.80	1.796	11.13	.91	11	.19	-12.84

Table 3.4.7 (cont'd.)

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: VIIE B/Trawl ,	3128.,	.423,	.000,	.00,	1,	.501,	.025
FLT11: UK(E+W)Otter ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT12: UK(E+W)Beam t,	1.,	.000,	.000,	.00,	0,	.000,	.000
P shrinkage mean ,	4773.,	.51,,,,				.356,	.016
F shrinkage mean ,	6249.,	.80,,,,				.143,	.013

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
4014.,	.30,	.26,	3,	.854,	.020

Age 2 Catchability dependent on age and year class strength

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: VIIE B/Trawl ,	2056.,	.269,	.019,	.07,	2,	.545,	.133
FLT11: UK(E+W)Otter ,	2293.,	.423,	.000,	.00,	1,	.221,	.120
FLT12: UK(E+W)Beam t,	1436.,	2.139,	.000,	.00,	1,	.009,	.186
P shrinkage mean ,	3724.,	.54,,,,				.155,	.076
F shrinkage mean ,	1771.,	.80,,,,				.070,	.153

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
2278.,	.20,	.11,	6,	.521,	.121

Age 3 Catchability dependent on age and year class strength

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: VIIE B/Trawl ,	1649.,	.196,	.176,	.90,	3,	.477,	.550
FLT11: UK(E+W)Otter ,	1265.,	.243,	.128,	.53,	2,	.325,	.671
FLT12: UK(E+W)Beam t,	2172.,	.643,	.577,	.90,	2,	.048,	.442
P shrinkage mean ,	1793.,	.62,,,,				.093,	.515
F shrinkage mean ,	1299.,	.80,,,,				.057,	.658

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1524.,	.15,	.10,	9,	.663,	.584

Table 3.4.7 (cont'd.)

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: VIIE B/Trawl ,	302.,	.189,	.039,	.20,	4,	.408,	1.061
FLT11: UK(E+W)Otter ,	281.,	.206,	.029,	.14,	3,	.393,	1.107
FLT12: UK(E+W)Beam t,	557.,	.420,	.056,	.13,	3,	.107,	.704
F shrinkage mean ,	439.,	.80,,,,				.092,	.831

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
324.,	.14,	.07,	11,	.520,	1.014

Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: VIIE B/Trawl ,	109.,	.195,	.032,	.17,	5,	.416,	.950
FLT11: UK(E+W)Otter ,	100.,	.209,	.047,	.22,	4,	.346,	1.007
FLT12: UK(E+W)Beam t,	202.,	.344,	.030,	.09,	4,	.153,	.619
F shrinkage mean ,	159.,	.80,,,,				.085,	.737

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
120.,	.14,	.07,	14,	.526,	.893

Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: VIIE B/Trawl ,	59.,	.186,	.089,	.48,	5,	.223,	.779
FLT11: UK(E+W)Otter ,	47.,	.202,	.048,	.24,	5,	.483,	.913
FLT12: UK(E+W)Beam t,	103.,	.316,	.107,	.34,	5,	.203,	.519
F shrinkage mean ,	79.,	.80,,,,				.091,	.630

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
61.,	.14,	.09,	16,	.614,	.766

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: VIIE B/Trawl ,	89.,	.184,	.069,	.37,	5,	.139,	.676
FLT11: UK(E+W)Otter ,	75.,	.197,	.061,	.31,	6,	.478,	.765
FLT12: UK(E+W)Beam t,	141.,	.276,	.074,	.27,	6,	.294,	.474
F shrinkage mean ,	102.,	.80,,,,				.089,	.610

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
95.,	.15,	.07,	18,	.513,	.644

Table 3.4.7 (cont'd.)

Age 8 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1986

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: VIIE B/Trawl ,	67.,	.187,	.132,	.70,	5,	.083,	.589
FLT11: UK(E+W)Otter ,	51.,	.213,	.144,	.68,	7,	.461,	.719
FLT12: UK(E+W)Beam t,	97.,	.265,	.059,	.22,	7,	.355,	.442
F shrinkage mean ,	63.,	.80,,,,				.101,	.613

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
67.,	.16,	.09,	20,	.565,	.589

Age 9 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1985

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: VIIE B/Trawl ,	65.,	.181,	.097,	.54,	5,	.058,	.651
FLT11: UK(E+W)Otter ,	53.,	.193,	.040,	.21,	8,	.422,	.751
FLT12: UK(E+W)Beam t,	86.,	.209,	.070,	.33,	8,	.445,	.523
F shrinkage mean ,	56.,	.80,,,,				.075,	.727

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
67.,	.14,	.06,	22,	.437,	.635

Table 3.4.8

Run title : Plaice in VIIe (run: XSA95/X95)

At 9-Sep-95 09:49:38

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE									
1,	.0070,	.0032,	.0160,	.0030,	.0032,	.0167,	.0131,	.0006,	.0121,
2,	.1359,	.2200,	.1563,	.2292,	.1367,	.1320,	.1353,	.1578,	.2285,
3,	.5404,	.6363,	.5250,	.7971,	.5083,	.5312,	.5348,	.5407,	.4881,
4,	.4130,	.4257,	.4152,	.6209,	.5180,	.5103,	.6581,	.8029,	.7490,
5,	.4815,	.3717,	.3652,	.5015,	.4093,	.4379,	.4945,	.6483,	.5735,
6,	.3812,	.3812,	.3511,	.3203,	.8853,	.3147,	.6217,	.3652,	.3570,
7,	.3618,	.3280,	.3616,	.4136,	.4078,	.6136,	.4258,	.6011,	.5449,
8,	.5366,	.4831,	.4574,	.4935,	.3762,	.5340,	1.0689,	.3672,	.8281,
9,	.4420,	.3924,	.3852,	.4340,	.5220,	.4771,	.6561,	.4976,	.5023,
+gp,	.4420,	.3924,	.3852,	.4340,	.5220,	.4771,	.6561,	.4976,	.5023,
FBAR 3- 7,	.4356,	.4286,	.4036,	.5307,	.5457,	.4815,	.5470,	.5917,	.5425,

Table 8 Fishing mortality (F) at age YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	FBAR 92-94
AGE											
1,	.0005,	.0008,	.0067,	.0015,	.0032,	.0169,	.0110,	.0202,	.0116,	.0195,	.0171,
2,	.1074,	.1765,	.0959,	.2034,	.0371,	.1221,	.1976,	.2287,	.1784,	.1210,	.1760,
3,	.4884,	.6340,	.5967,	.5881,	.4409,	.6580,	.6291,	.7670,	.7762,	.5838,	.7090,
4,	.6645,	.4639,	.7406,	.4532,	.6720,	.8066,	.8320,	.8906,	.9310,	1.0139,	.9452,
5,	.4110,	.5088,	.8444,	.5342,	.7888,	.6036,	.6533,	.7405,	.8798,	.8929,	.8377,
6,	.6383,	.3780,	.5119,	.3477,	.6561,	.5856,	.4913,	.6731,	.7270,	.7656,	.7219,
7,	.5268,	.7575,	.4887,	.3478,	.5318,	.7545,	.4392,	.4738,	.8368,	.6440,	.6515,
8,	.2466,	.4709,	.5903,	.5073,	.6804,	.6929,	.4815,	.5310,	.6660,	.5890,	.5953,
9,	.3434,	.5945,	.5112,	.4980,	1.0941,	.8604,	.5993,	.6383,	.6199,	.6351,	.6311,
+gp,	.3434,	.5945,	.5112,	.4980,	1.0941,	.8604,	.5993,	.6383,	.6199,	.6351,	
FBAR 3- 7,	.5458,	.5484,	.6365,	.4542,	.6179,	.6817,	.6090,	.7090,	.8302,	.7800,	

Table 3.4.9

Run title : Plaice in VIIe (run: XSA95/X95)

At 9-Sep-95 09:49:38

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-3									
YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE									
1,	3791,	2009,	3082,	6984,	6380,	2626,	5884,	5395,	6817,
2,	886,	3338,	1776,	2690,	6175,	5640,	2291,	5151,	4782,
3,	1577,	686,	2376,	1347,	1897,	4777,	4384,	1775,	3901,
4,	490,	815,	322,	1247,	538,	1012,	2491,	2278,	917,
5,	306,	287,	472,	188,	594,	284,	539,	1144,	905,
6,	194,	168,	176,	291,	101,	350,	163,	292,	531,
7,	206,	118,	101,	110,	187,	37,	227,	78,	179,
8,	95,	127,	75,	63,	64,	110,	18,	131,	38,
9,	42,	49,	70,	42,	34,	39,	57,	5,	81,
+gp,	234,	192,	218,	246,	337,	223,	252,	248,	115,
TOTAL,	7819,	7789,	8668,	13207,	16309,	15100,	16304,	16495,	18265,

Table 10 Stock number at age (start of year) Numbers*10**-3												
YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	GMST
AGE												
1,	6618,	13486,	11770,	8366,	3343,	3620,	3991,	4777,	3306,	4615,	0,	513
2,	5973,	5867,	11952,	10370,	7409,	2955,	3157,	3501,	4152,	2899,	4014,	412
3,	3375,	4758,	4362,	9631,	7505,	6332,	2320,	2298,	2470,	3081,	2278,	304
4,	2124,	1837,	2239,	2130,	4744,	4283,	2908,	1097,	946,	1008,	1524,	144
5,	384,	969,	1024,	947,	1201,	2149,	1696,	1122,	399,	331,	324,	67
6,	452,	226,	517,	390,	492,	484,	1042,	782,	475,	147,	120,	32
7,	329,	212,	137,	275,	245,	226,	239,	566,	354,	204,	61,	17
8,	92,	172,	88,	75,	172,	127,	94,	137,	312,	136,	95,	8
9,	15,	64,	96,	43,	40,	77,	57,	52,	71,	142,	67,	4
+gp,	175,	139,	121,	108,	136,	100,	98,	92,	169,	92,	110,	
TOTAL,	19538,	27730,	32306,	32335,	25285,	20354,	15602,	14423,	12656,	12654,	8593,	

Table 3.4.10

Run title : Plaice in VIIe (run: XSA95/X95)

At 9-Sep-95 09:49:38

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 3- 7,
1976,	3791,	2149,	1329,	640,	.4817,	.4356,
1977,	2009,	2380,	1369,	702,	.5128,	.4286,
1978,	3082,	2593,	1510,	784,	.5193,	.4036,
1979,	6984,	3191,	1644,	977,	.5942,	.5307,
1980,	6380,	4094,	1865,	1079,	.5786,	.5457,
1981,	2626,	4945,	2558,	1501,	.5868,	.4815,
1982,	5884,	4485,	2736,	1688,	.6170,	.5470,
1983,	5395,	4613,	2670,	1495,	.5600,	.5917,
1984,	6817,	4824,	2536,	1547,	.6100,	.5425,
1985,	6618,	5187,	2756,	1441,	.5228,	.5458,
1986,	13486,	5779,	2818,	1810,	.6422,	.5484,
1987,	11770,	5405,	2627,	1958,	.7455,	.6365,
1988,	8366,	7355,	3594,	2458,	.6838,	.4542,
1989,	3343,	6855,	4116,	2358,	.5729,	.6179,
1990,	3620,	6507,	4042,	2593,	.6415,	.6817,
1991,	3991,	4881,	3172,	1848,	.5826,	.6090,
1992,	4777,	4774,	2492,	1624,	.6516,	.7090,
1993,	3306,	3849,	2012,	1417,	.7043,	.8302,
1994,	4615,	3626,	1677,	1156,	.6891,	.7800,
Arith. Mean	5624,	4605,	2501,	1530,	.6051,	.5747,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

Table 3.4.11

Plaice in the Western English Channel (Fishing Area VIIe)

08:05 Saturday, September 9, 1995

Single option prediction: Input data

Year: 1995								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	5136.000	0.1200	0.0000	0.0000	0.0000	0.204	0.0170	0.227
2	4014.000	0.1200	0.1500	0.0000	0.0000	0.253	0.1780	0.281
3	2278.000	0.1200	0.5300	0.0000	0.0000	0.311	0.7150	0.343
4	1524.000	0.1200	0.9600	0.0000	0.0000	0.378	0.9540	0.415
5	324.000	0.1200	1.0000	0.0000	0.0000	0.454	0.8460	0.496
6	120.000	0.1200	1.0000	0.0000	0.0000	0.540	0.7290	0.586
7	61.000	0.1200	1.0000	0.0000	0.0000	0.634	0.6570	0.685
8	95.000	0.1200	1.0000	0.0000	0.0000	0.738	0.6000	0.793
9	67.000	0.1200	1.0000	0.0000	0.0000	0.850	0.6360	0.910
10+	110.000	0.1200	1.0000	0.0000	0.0000	1.190	0.6360	1.261
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1996								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	5136.000	0.1200	0.0000	0.0000	0.0000	0.204	0.0170	0.227
2	.	0.1200	0.1500	0.0000	0.0000	0.253	0.1780	0.281
3	.	0.1200	0.5300	0.0000	0.0000	0.311	0.7150	0.343
4	.	0.1200	0.9600	0.0000	0.0000	0.378	0.9540	0.415
5	.	0.1200	1.0000	0.0000	0.0000	0.454	0.8460	0.496
6	.	0.1200	1.0000	0.0000	0.0000	0.540	0.7290	0.586
7	.	0.1200	1.0000	0.0000	0.0000	0.634	0.6570	0.685
8	.	0.1200	1.0000	0.0000	0.0000	0.738	0.6000	0.793
9	.	0.1200	1.0000	0.0000	0.0000	0.850	0.6360	0.910
10+	.	0.1200	1.0000	0.0000	0.0000	1.190	0.6360	1.261
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	5136.000	0.1200	0.0000	0.0000	0.0000	0.204	0.0170	0.227
2	.	0.1200	0.1500	0.0000	0.0000	0.253	0.1780	0.281
3	.	0.1200	0.5300	0.0000	0.0000	0.311	0.7150	0.343
4	.	0.1200	0.9600	0.0000	0.0000	0.378	0.9540	0.415
5	.	0.1200	1.0000	0.0000	0.0000	0.454	0.8460	0.496
6	.	0.1200	1.0000	0.0000	0.0000	0.540	0.7290	0.586
7	.	0.1200	1.0000	0.0000	0.0000	0.634	0.6570	0.685
8	.	0.1200	1.0000	0.0000	0.0000	0.738	0.6000	0.793
9	.	0.1200	1.0000	0.0000	0.0000	0.850	0.6360	0.910
10+	.	0.1200	1.0000	0.0000	0.0000	1.190	0.6360	1.261
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : PRED95
Date and time: 09SEP95:10:06

Table 3.4.12

Plaice in the Western English Channel (Fishing Area VIIe) 08:05 Saturday, September 9,

Yield per recruit: Summary table

						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	8.843	6038.721	6.692	5519.043	6.692	5519.043
0.1000	0.0780	0.308	206.490	6.285	3414.280	4.144	2898.064	4.144	2898.064
0.2000	0.1560	0.452	262.908	5.086	2305.833	2.956	1792.955	2.956	1792.955
0.3000	0.2341	0.535	277.809	4.403	1738.399	2.283	1228.743	2.283	1228.743
0.4000	0.3121	0.588	279.662	3.967	1412.283	1.857	905.742	1.857	905.742
0.5000	0.3901	0.624	277.469	3.667	1208.889	1.566	705.361	1.566	705.361
0.6000	0.4681	0.651	274.292	3.449	1073.737	1.358	573.126	1.358	573.126
0.7000	0.5461	0.671	271.161	3.283	979.162	1.201	481.378	1.201	481.378
0.8000	0.6242	0.687	268.381	3.153	910.043	1.080	415.001	1.080	415.001
0.9000	0.7022	0.700	265.998	3.049	857.625	0.984	365.246	0.984	365.246
1.0000	0.7802	0.711	263.973	2.962	816.596	0.905	326.802	0.905	326.802
1.1000	0.8582	0.720	262.249	2.889	783.599	0.840	296.319	0.840	296.319
1.2000	0.9362	0.728	260.769	2.826	756.437	0.786	271.605	0.786	271.605
1.3000	1.0143	0.735	259.485	2.772	733.630	0.739	251.180	0.739	251.180
1.4000	1.0923	0.741	258.361	2.724	714.150	0.699	234.020	0.699	234.020
1.5000	1.1703	0.747	257.366	2.681	697.264	0.663	219.397	0.663	219.397
1.6000	1.2483	0.752	256.478	2.643	682.442	0.632	206.781	0.632	206.781
1.7000	1.3263	0.756	255.678	2.608	669.286	0.605	195.780	0.605	195.780
1.8000	1.4044	0.760	254.952	2.577	657.498	0.580	186.096	0.580	186.096
1.9000	1.4824	0.764	254.289	2.548	646.847	0.558	177.500	0.558	177.500
2.0000	1.5604	0.768	253.679	2.521	637.152	0.537	169.814	0.537	169.814
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YPR95
Date and time : 09SEP95:10:30
Computation of ref. F: Simple mean, age 3 - 7
F-0.1 factor : 0.1755
F-max factor : 0.3769
F-0.1 reference F : 0.1369
F-max reference F : 0.2941
Recruitment : Single recruit

Table 3.4.13

Plaice in the Western English Channel (Fishing Area VIIe) 08:05 Saturday, September 9,

Prediction with management option table

Year: 1995					Year: 1996					Year: 1997	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.7802	3853	1589	1203	0.0000	0.0000	3972	1514	0	5339	2694
.	.	.	.	.	0.1000	0.0780	.	1514	161	5173	2543
.	.	.	.	.	0.2000	0.1560	.	1514	311	5019	2403
.	.	.	.	.	0.3000	0.2341	.	1514	452	4875	2273
.	.	.	.	.	0.4000	0.3121	.	1514	583	4740	2151
.	.	.	.	.	0.5000	0.3901	.	1514	706	4614	2039
.	.	.	.	.	0.6000	0.4681	.	1514	821	4496	1934
.	.	.	.	.	0.7000	0.5461	.	1514	929	4386	1836
.	.	.	.	.	0.8000	0.6242	.	1514	1030	4283	1745
.	.	.	.	.	0.9000	0.7022	.	1514	1125	4186	1661
.	.	.	.	.	1.0000	0.7802	.	1514	1214	4095	1582
.	.	.	.	.	1.1000	0.8582	.	1514	1298	4010	1508
.	.	.	.	.	1.2000	0.9362	.	1514	1377	3930	1440
.	.	.	.	.	1.3000	1.0143	.	1514	1451	3855	1376
.	.	.	.	.	1.4000	1.0923	.	1514	1521	3784	1316
.	.	.	.	.	1.5000	1.1703	.	1514	1587	3718	1260
.	.	.	.	.	1.6000	1.2483	.	1514	1650	3655	1208
.	.	.	.	.	1.7000	1.3263	.	1514	1708	3596	1159
.	.	.	.	.	1.8000	1.4044	.	1514	1764	3540	1113
.	.	.	.	.	1.9000	1.4824	.	1514	1817	3487	1070
.	.	.	.	.	2.0000	1.5604	.	1514	1866	3438	1030
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : PREDMO95
Date and time : 09SEP95:10:19
Computation of ref. F: Simple mean, age 3 - 7
Basis for 1995 : F factors

Table 3.4.14

Plaice in the Western English Channel (Fishing Area VIIe)

08:05 Saturday, September 9, 1995

Single option prediction: Detailed tables

Year: 1995 F-factor: 1.0000 Reference F: 0.7802

Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1	0.0170	82	19	5136	1046	0	0	0	0
2	0.1780	618	173	4014	1014	602	152	602	152
3	0.7150	1104	379	2278	708	1207	375	1207	375
4	0.9540	891	370	1524	576	1463	553	1463	553
5	0.8460	176	87	324	147	324	147	324	147
6	0.7290	59	35	120	65	120	65	120	65
7	0.6570	28	19	61	39	61	39	61	39
8	0.6000	41	32	95	70	95	70	95	70
9	0.6360	30	27	67	57	67	57	67	57
10+	0.6360	49	62	110	131	110	131	110	131
Total		3077	1203	13729	3853	4049	1589	4049	1589
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1996 F-factor: 1.0000 Reference F: 0.7802

Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1	0.0170	82	19	5136	1046	0	0	0	0
2	0.1780	689	193	4478	1132	672	170	672	170
3	0.7150	1444	496	2980	927	1579	491	1579	491
4	0.9540	578	240	988	374	949	359	949	359
5	0.8460	282	140	521	237	521	237	521	237
6	0.7290	61	35	123	67	123	67	123	67
7	0.6570	23	16	51	33	51	33	51	33
8	0.6000	12	10	28	21	28	21	28	21
9	0.6360	21	19	46	39	46	39	46	39
10+	0.6360	37	47	83	99	83	99	83	99
Total		3230	1214	14435	3972	4052	1514	4052	1514
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1997 F-factor: 1.0000 Reference F: 0.7802

Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1	0.0170	82	19	5136	1046	0	0	0	0
2	0.1780	689	193	4478	1132	672	170	672	170
3	0.7150	1612	553	3324	1034	1762	548	1762	548
4	0.9540	756	314	1293	489	1241	469	1241	469
5	0.8460	183	91	338	153	338	153	338	153
6	0.7290	97	57	198	107	198	107	198	107
7	0.6570	24	17	53	33	53	33	53	33
8	0.6000	10	8	24	17	24	17	24	17
9	0.6360	6	6	14	12	14	12	14	12
10+	0.6360	27	34	61	72	61	72	61	72
Total		3486	1291	14918	4095	4361	1582	4361	1582
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : PRED95
Date and time : 09SEP95:10:06
Computation of ref. F: Simple mean, age 3 - 7
Prediction basis : F factors

Table 3.4.15

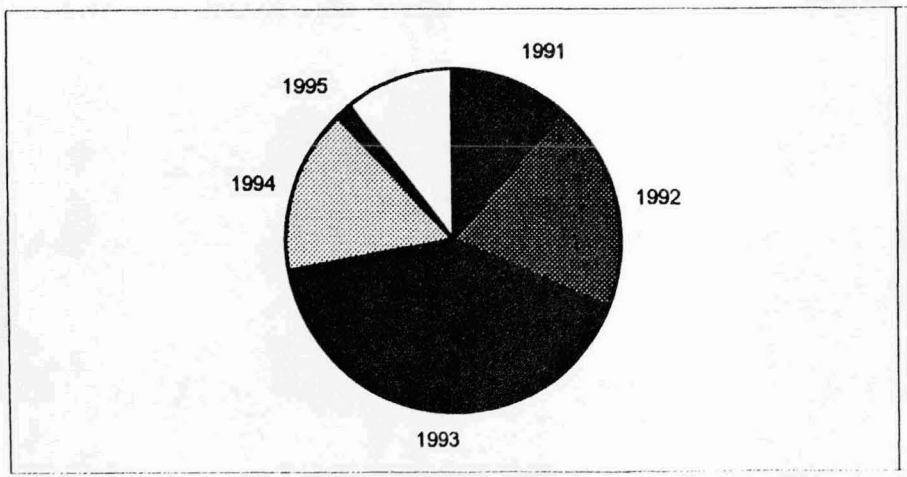
Western Channel Plaice. Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class	1991	1992	1993	1994	1995
Stock No. (thousands) of one-year-olds	4777	3306	4615	5136	5136
Source	VPA	VPA	VPA	GM	GM
Status Quo F:					
% in 1995 catch	30.8	31.5	14.4	1.6	-
% in 1996 catch	11.5	19.8	40.8	15.9	1.6
% in 1995 SSB	34.8	23.6	9.6	0.0	-
% in 1996 SSB	15.6	23.7	32.4	11.2	0.0
% in 1997 SSB	6.8	9.7	29.7	34.7	10.8

GM= geometric mean recruitment

VIIe plaice : Year-class % contribution to a) 1996 landings and b) 1997 SSB

a



b

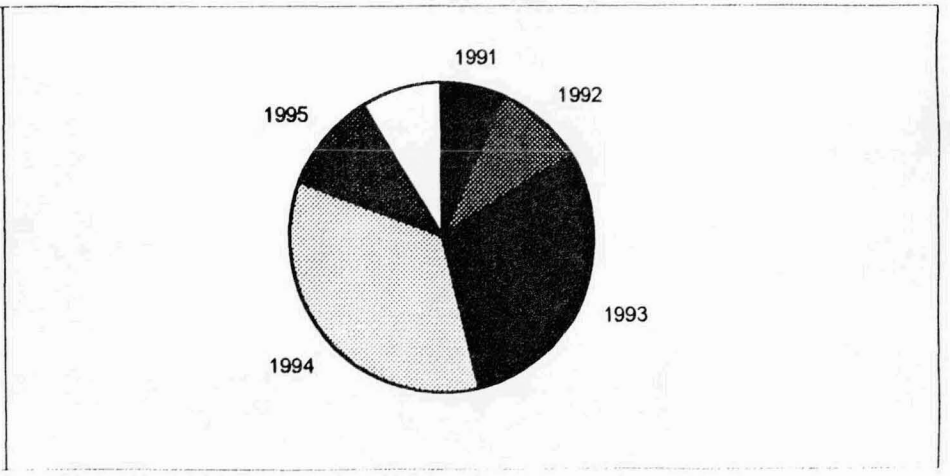


Figure 3.4.1a VIIe PLAICE RETROSPECTIVE XSA : qp=7 shr=0.5 rec=1-3

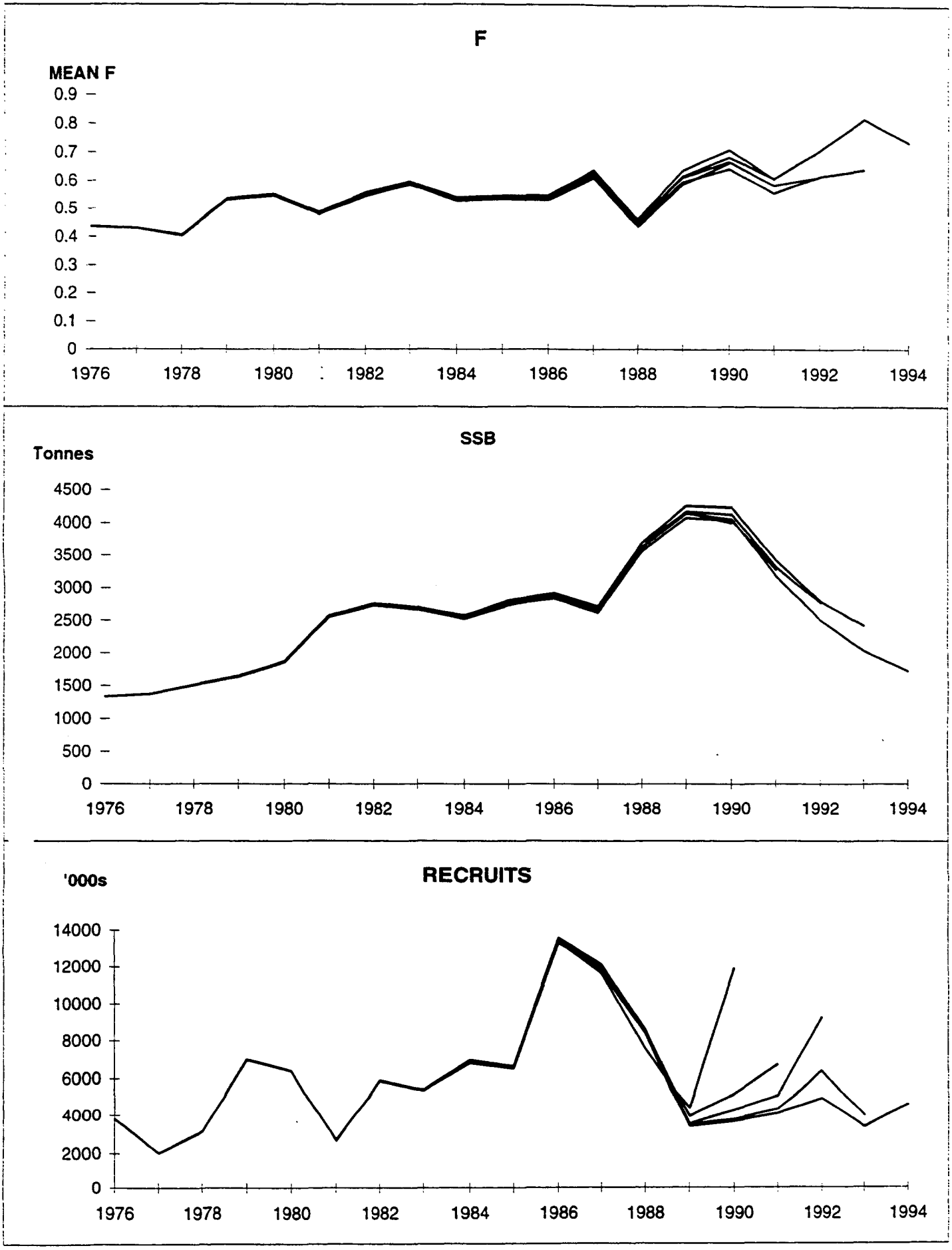


Figure 3.4.1b **VIIe PLAICE RETROSPECTIVE XSA :** **qp=7 shr=0.8 rec=1-3**

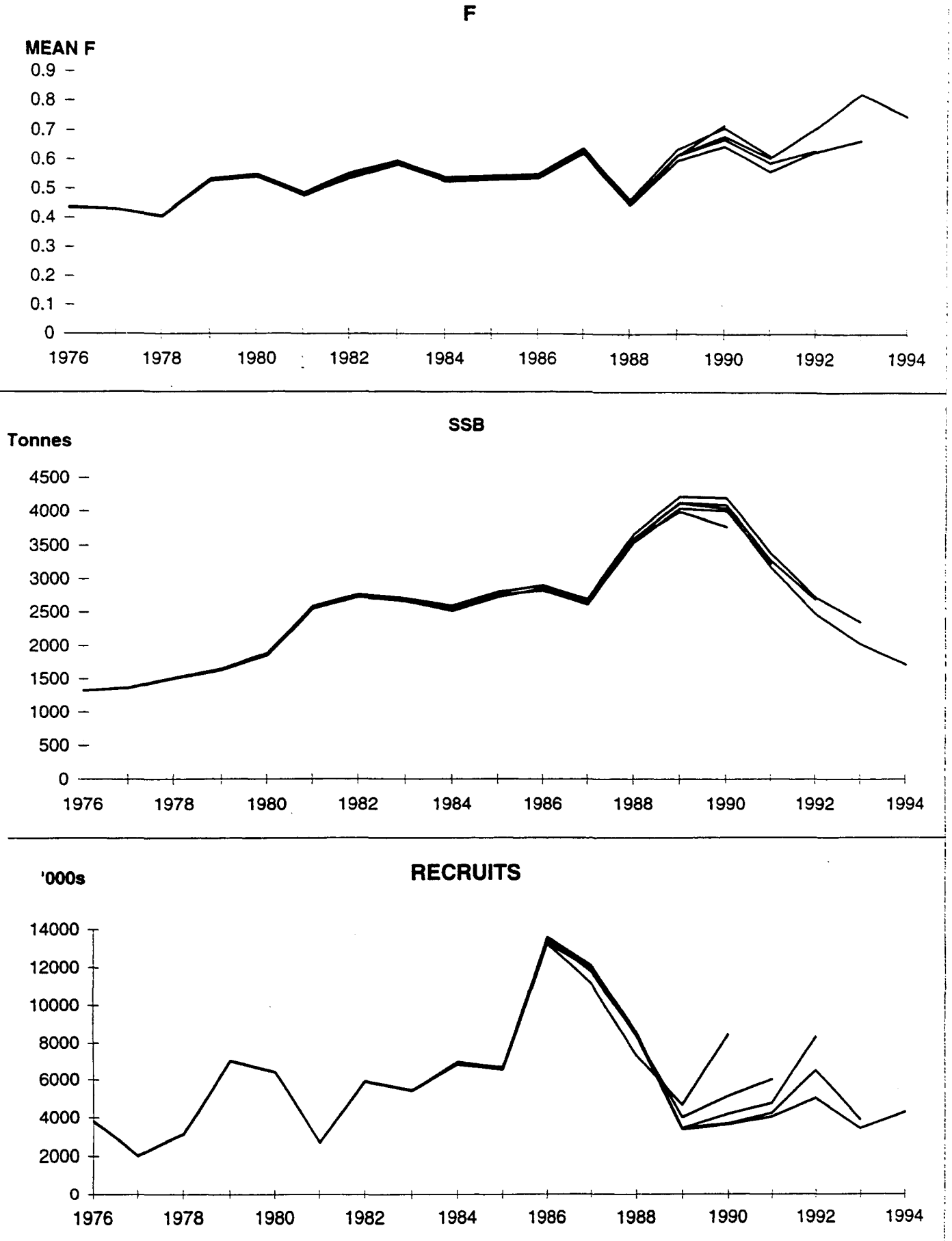


Figure 3.4.1c VIIe PLAICE RETROSPECTIVE XSA : qp=7 shr=1.1 rec=1-3

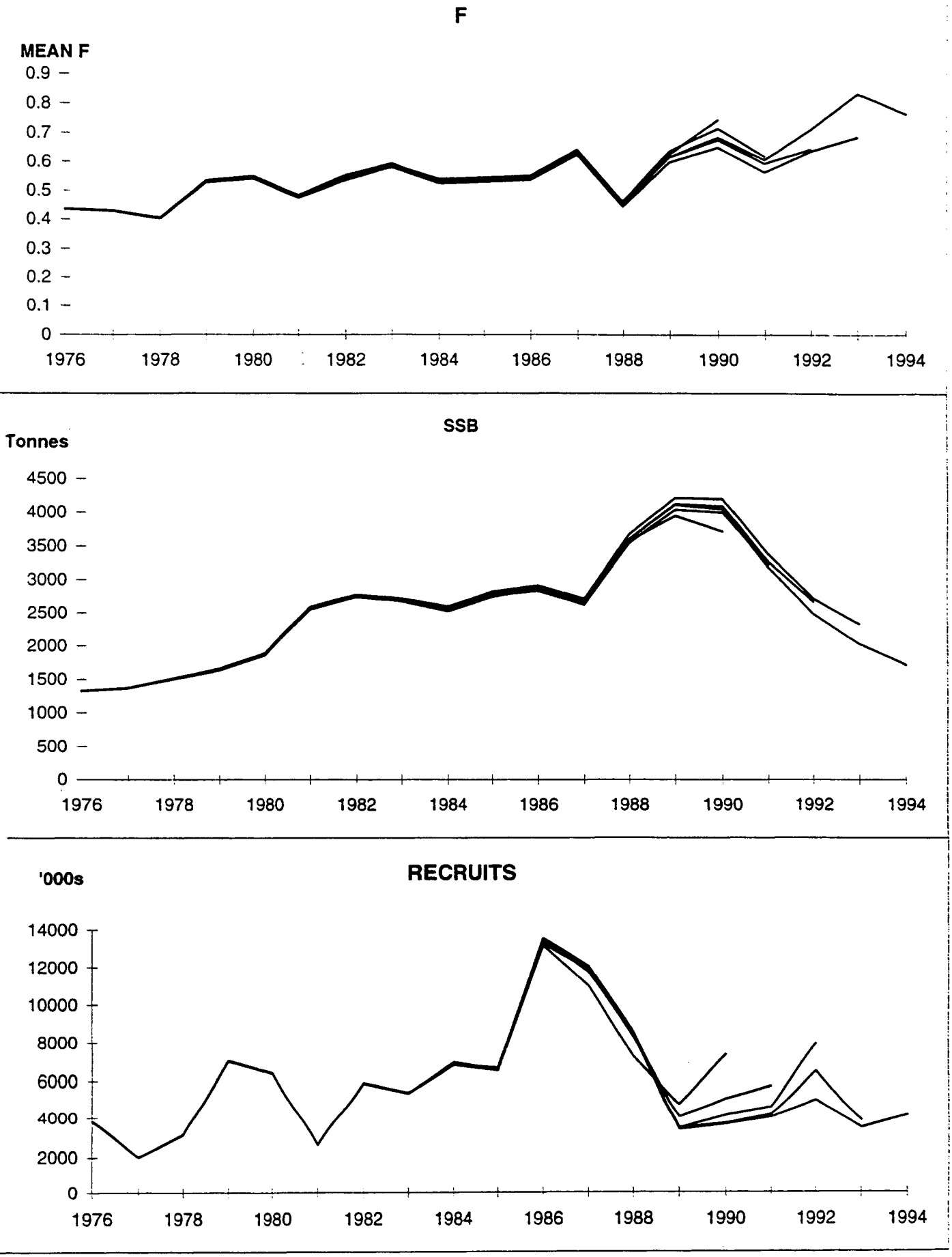


Figure 3.4.2 **VIIe PLAICE XSA LOG CATCHABILITY RESIDUAL PLOTS (AGES 1-6)**

UK(E+W)Beam trawl ■
UK(E+W)Otter trawl ◆
Belgium B/T - FORcor ▲

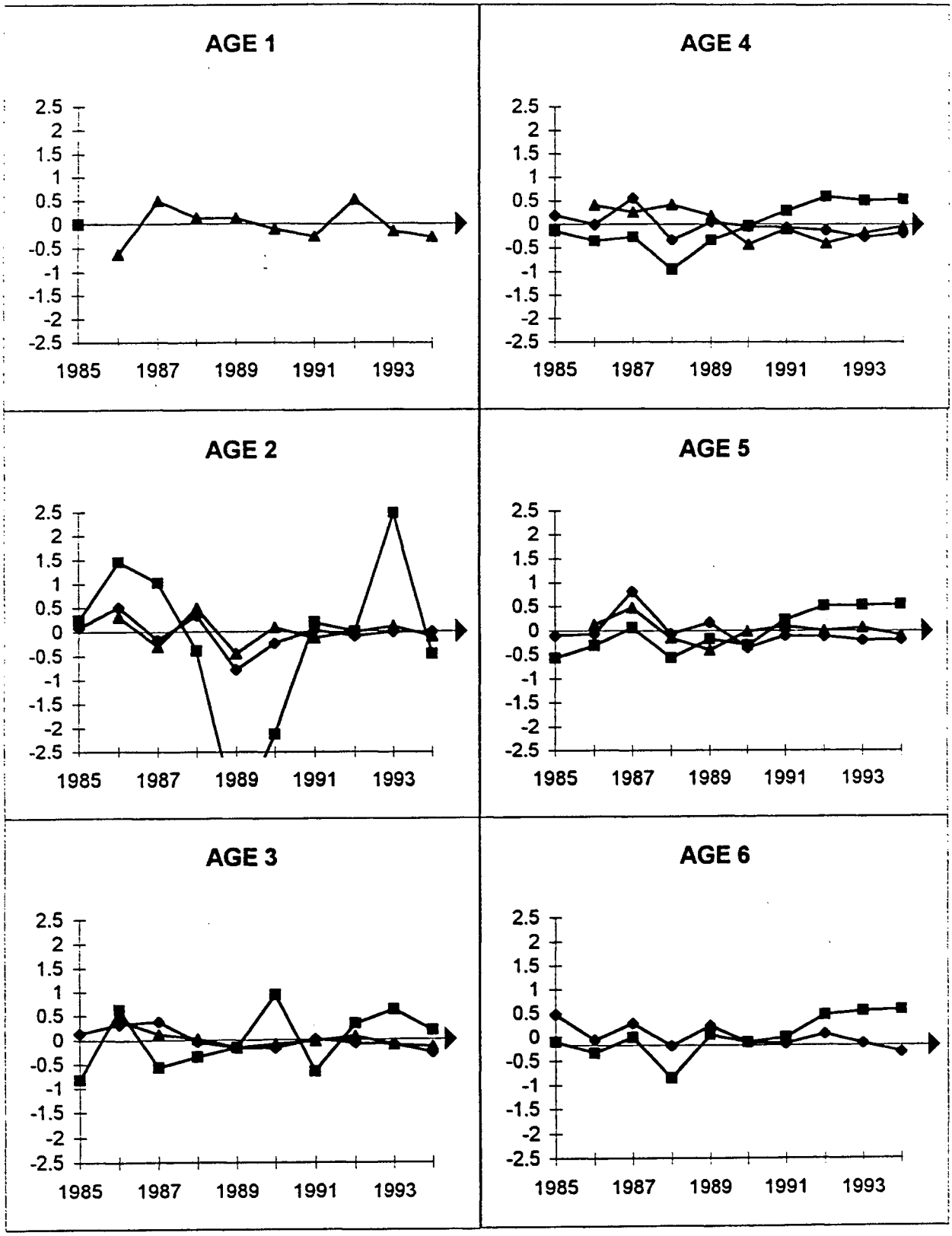


Figure 3.4.2 (cont'd.) **VIIe PLAICE XSA LOG CATCHABILITY RESIDUAL PLOTS (AGES 7-9)**

UK(E+W)Beam trawl ■
UK(E+W)Otter trawl ◆
VIIE B/Trawl Survey ▲

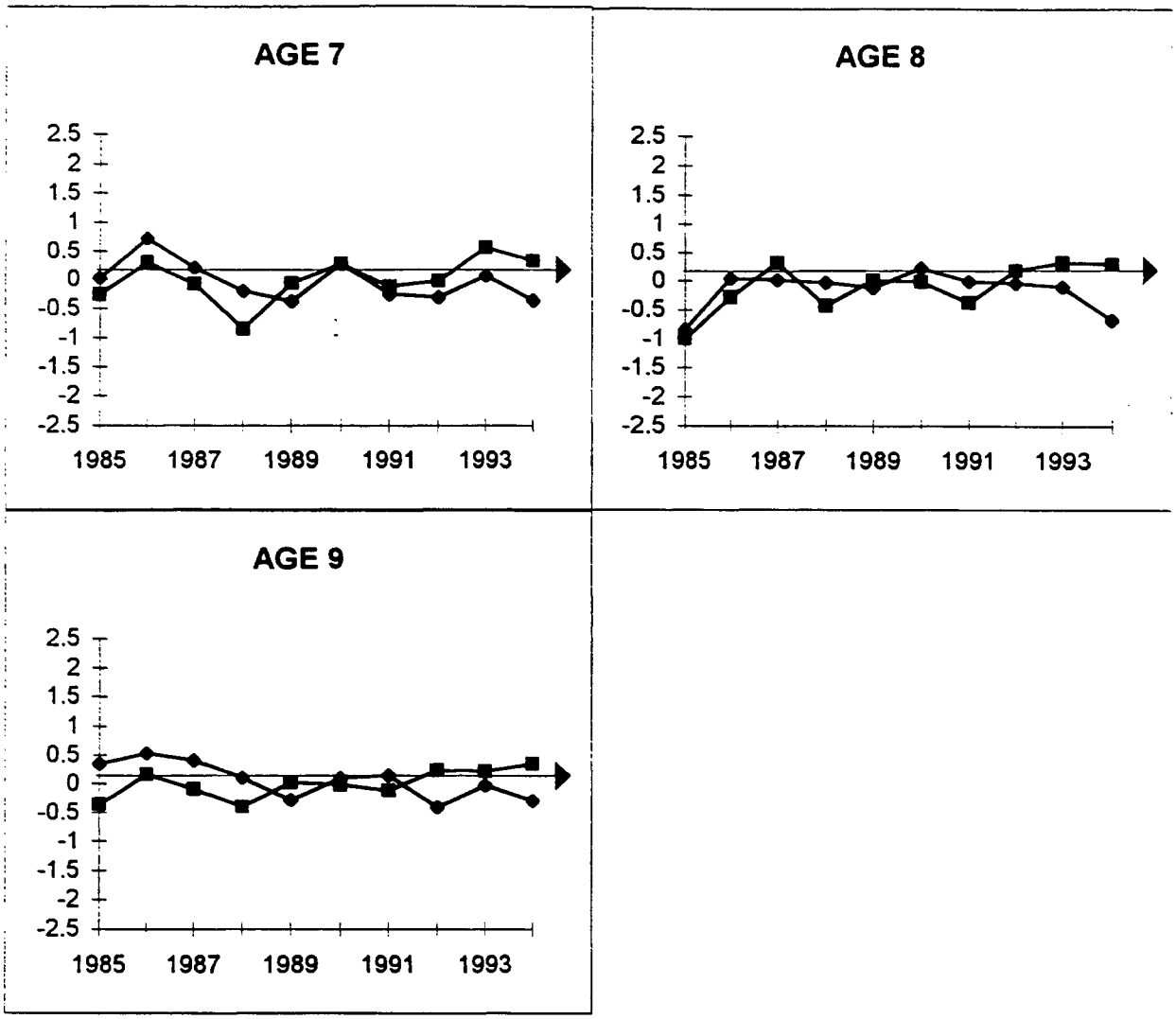
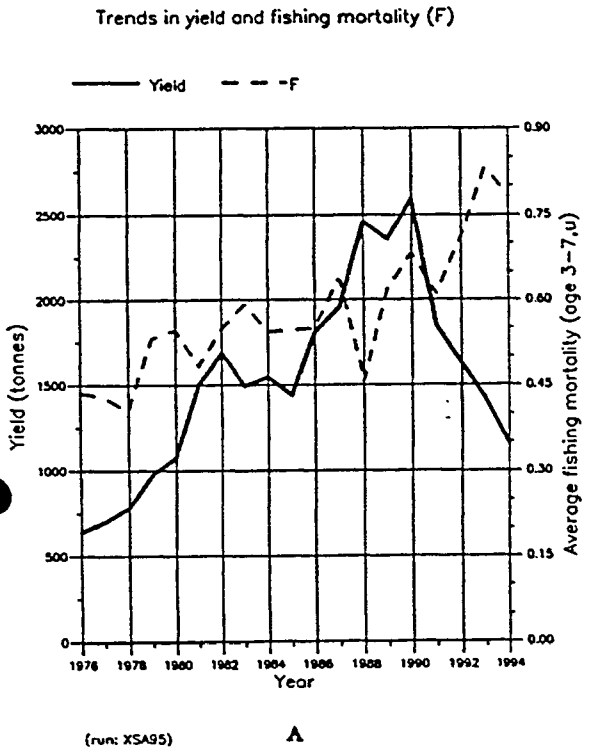
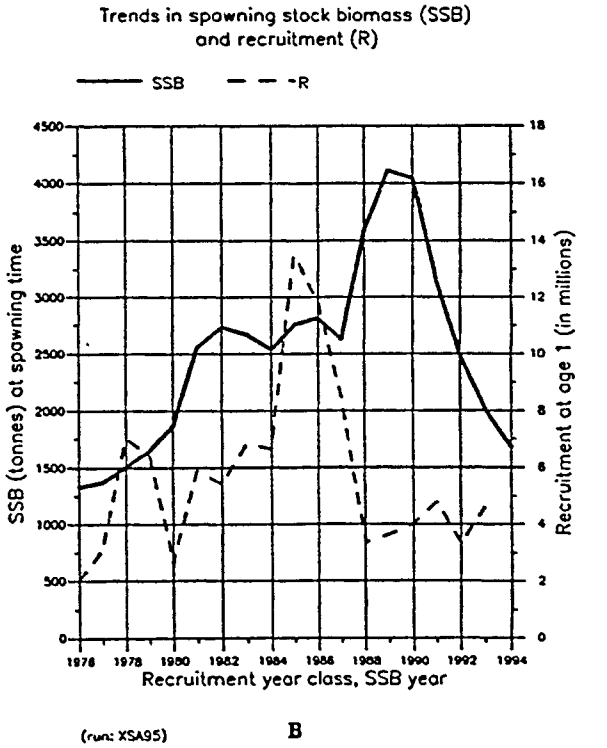


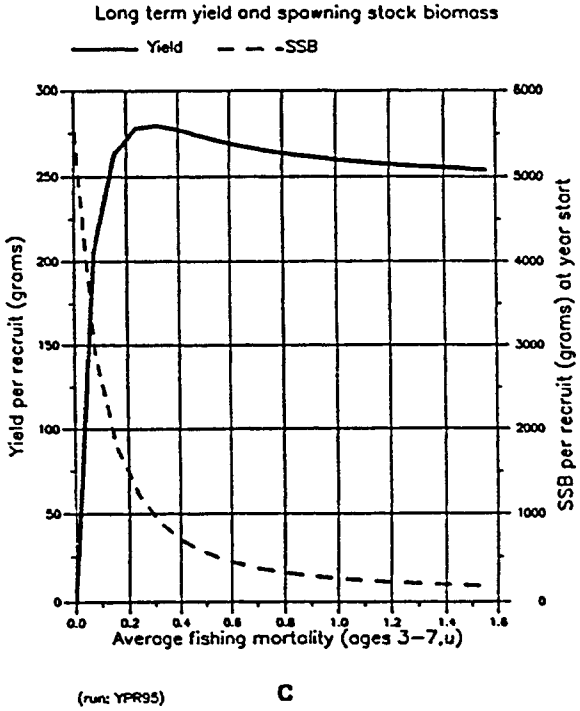
Figure 3.4.3

FISH STOCK SUMMARY
STOCK: Plaice in the Western English Channel (Fishing Area VIIe)
8-9-1995





FISH STOCK SUMMARY
STOCK: Plaice in the Western English Channel (Fishing Area VIIe)
8-9-1995



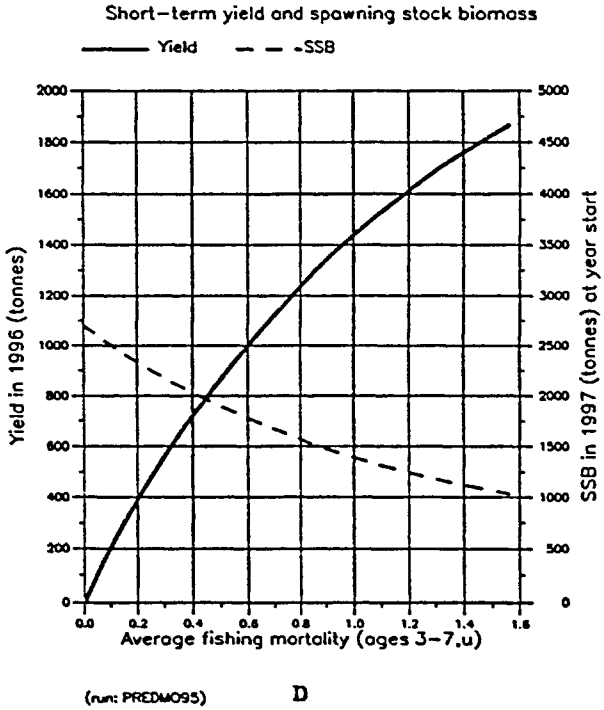
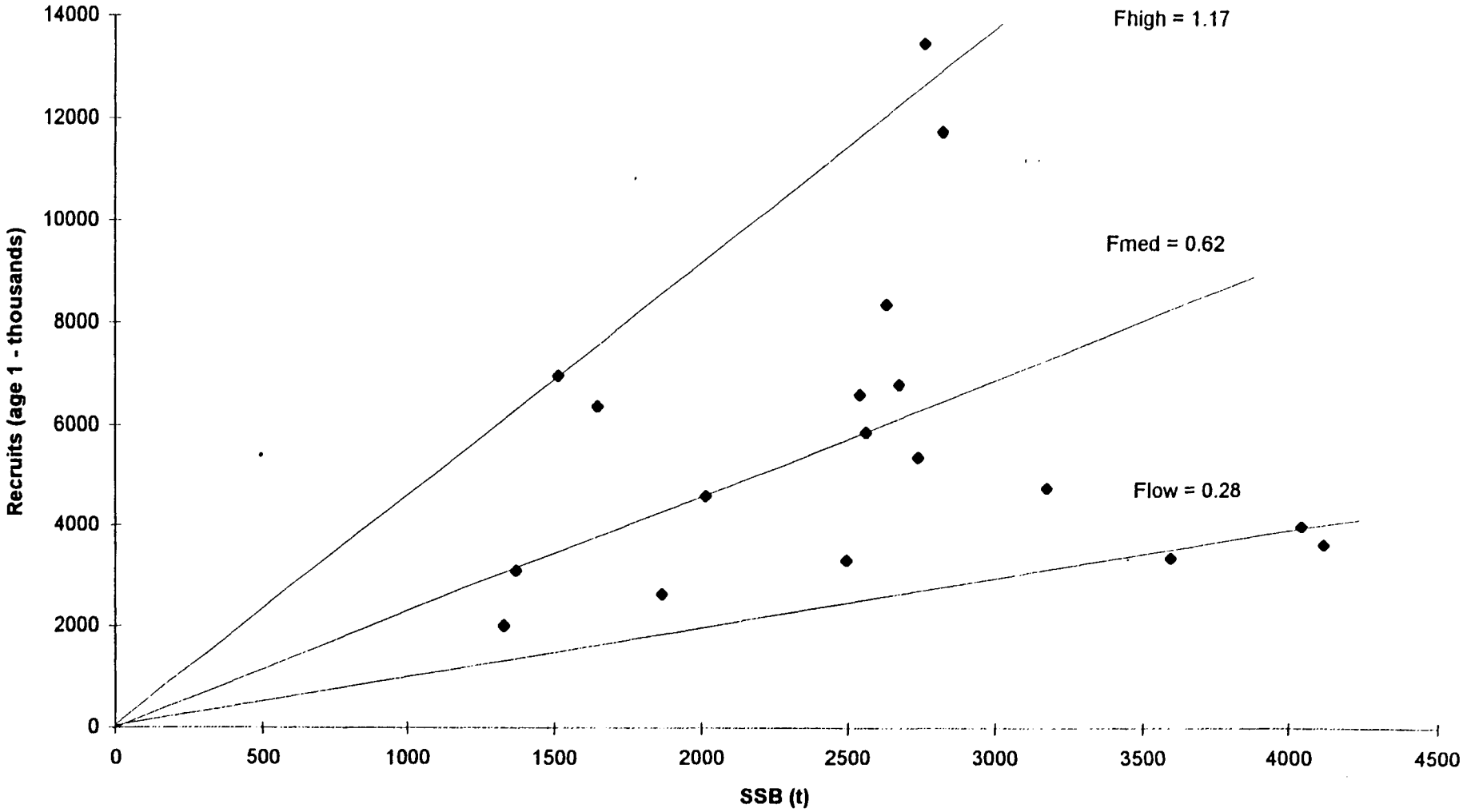


Figure 3.4.4 **Western Channel plaice stock-recruitment**



4. CELTIC SEA STOCKS

4.1 Celtic Sea cod (Divisions VIIf, VIIg and VIIh)

As last year, the assessment of the Celtic Sea stock of cod includes data for Division VIIh. There are no estimates of discards for this stock.

A major problem for this assessment is that the 1994 catches and efforts by Division were not available for part of the Brittany fleet, which usually contributes the majority of the catches of Celtic Sea cod. As explained in section 1.4, the missing data were estimated, assuming that landings by quarter and ICES Division in 1994 had kept the same pattern as in 1993. When landings were sampled for length by market category, the pattern of the years 1991 to 1993 was used to estimate the 1994 quarterly landings by market category and ICES Division (Bellail, WP).

4.1.1 Landings, effort and CPUE trends

In 1994, the estimate of international landings was about 8,500 t which represents a 5 % decrease from 1993 and a 51 % decrease compared to the record high landings of 1989. The large landings in 1988, 1989 and 1990 were due to the very strong 1986 year class. Since 1991, landings have returned to the levels recorded in the period 1981-1987. Last year's *status quo* estimate of the 1994 catches for Divisions VIIf,g,h (7,100 t) was 16 % lower than the landings.

In 1995, the data for the French fisheries for the period 1983-1993 have been revised. The series of national landings from Divisions VIIf,g,h are shown in Table 4.1.1. In 1994, the share of landings between France, England and Wales, Belgium and Ireland remained as before: 79 %, 6 %, 5 % and 11 % respectively. Only Irish and Belgian landings increased from 1993 to 1994. Table 4.1.2 shows the trend of fishing effort and LPUE. During the period 1988-1992, LPUE of Lorient trawlers declined by 32 %, but increased in 1993. Fishing effort decreased significantly in 1993 due to a reduction of the fleet, which continued in 1994, though effort data for 1994 are not available for this fleet.

Even though cod is not the target species of the St Guenole and Loctudy *Nephrops* trawlers, their landings now exceed those of the Lorient trawlers due to their large fishing effort, and also because they use the same mesh size (80 mm) as demersal trawlers to avoid problems with the by-catch regulations.

The high catch rates of the French trawlers in 1988-1989 were due to the very strong 1986 year class. During that period, the LPUE of UK otter trawlers decreased in Division VIIf and in the eastern part of Division VIIg and increased elsewhere, and the LPUE of UK beam trawlers remained steady or increased in Division VIIg west.

As in previous years, no individual TACs were set for Divisions VIIf,g,h, and a precautionary TAC covered all of Sub-areas VII to X except Division VIIa (17,000t in 1994 and 1995).

4.1.2 Age and length compositions and weights at age

For Divisions VIIf,g,h in 1994, France provided quarterly length and age compositions for the *Nephrops* fleet, and estimates of the quarterly length and age compositions for the Lorient fleet. Ireland provided quarterly age compositions and mean weights at age for all gears combined. The UK provided quarterly length compositions for the landings of their otter trawlers and beam trawlers. Belgium provided quarterly landings. Length compositions by country and for the total catch are shown in Table 4.1.3.

The 1994 age compositions were derived as in previous years, i.e. the French ALKs were applied to English length compositions and the resulting sum of the quarterly age compositions was raised to account for landings by Belgium. The same procedure was used to revise the series since 1983. The series of catches at age is shown in Table 4.1.4.

The mean weights at age in the catches were derived by combining French, Irish and English data weighted by numbers caught at age (Table 4.1.5). The SOP check was 100%. As in previous years, the weights at age in the stock (Table 4.1.6) were taken as weights in the catch during the first quarter, except for age 1 which only appears in subsequent quarters depending on its abundance. Weights at age are variable from year to year but no trend is apparent, even though stock weights at some ages in 1994 are higher than in earlier years. These variations are dependent on how the fleets operate in the first quarter. For some of the older ages, mean weights in the stock are larger than weights in the catch, which is explained by the fact that catches on spawning concentrations in the first quarter include larger numbers of big fish than found later in the year.

ACFM noted again that mean weights at age in this stock are much larger than in other cod stocks. In France, until 1994, the boxes sampled in the markets were not weighed and the sample weights derived with the length-weight relationship used by the late Irish Sea and Celtic Sea Working Group (W g = 0.01861* L cm **2.90796, L = middle of length class) were probably overestimated. To validate the appropriateness of this relationship, length-weight data will be collected during the EVHOE Survey next November. Also, in the past, there have been no comparisons of otolith readings for Celtic Sea Cod

because ageing of Celtic Sea cod was considered straightforward. If necessary, an exchange of slides of otoliths or a Workshop under the auspices of ICES could be envisaged in order to obtain agreement on the interpretation of otolith patterns between regular readers.

As previously, the maturity ogive used assumes that age 1 fish are immature, 5% of age 2 fish are mature, and older fish fully mature. As in previous years, SSB is computed at 1st January of each year.

4.1.3 Estimation of fishing mortalities

The age range used in this assessment was 1-7+.

Revised landings at age and associated effort data were available on an annual basis for the same fleets as used previously, i.e. the Lorient gadoid trawlers fishing in Divisions VIIf,g,h for the period 1972-1993, the *Nephrops* trawlers From St Guenole and Loctudy for the period 1987-1994, and the Cirolana March Surveys in Divisions VIIf,g for 1987-1994.

This year, an attempt was made to breakdown the French fleets' data into quarterly "fleets", and these data resolution since 1983. Table 4.1.7 shows the CPUE data used for tuning (the old annual data are also maintained in the data base).

The catch-at-age data were first scrutinized by Separable VPA using input parameters consistent with results of preliminary tuning runs. The matrix of residuals (in ICES stock data file) reveals no particular problem.

Plots of Log-catchability residuals using unshrunk Laurec-Shepherd tuning with defaults and the oldest age F as average of 3 younger ages on each fleet individually, are also available in ICES files. As observed previously, some large residuals are apparent at age 4 in the French gadoid trawlers, data. The Nephrops trawlers data show no trend. The UK survey data are quite noisy, except for age 2. Part of the reason is that the area covered by the survey has been extended into Division VIIg since 1992.

Although the preparatory work was made with a more extended set of fleets, trial runs (in ICES stock file) showed that a taper time of 15 years improves the retrospective pattern, and this option was chosen. Last year, age 1 was treated as recruits and catchability was set independent of ages for ages 5 and older. However, results obtained with the new set of fleets show that the estimate of the 1993 year class is essentially driven by the *Nephrops* fleets (only 30% weight due to shrinkage; no 1994 data for Lorient fleets) but is poorly estimated by the 1st and 2nd quarter data.

Given the lack of 1994 data for the Lorient fleet, which previously had the largest weight, and considering that, for the *Nephrops* fleets in the 3rd and 4th quarters, the slopes are close to unity, it was decided to treat no age as recruits. The survey fleet poorly estimates population at age 1 and does not improve the quality of estimates for older ages, so it was removed from the final analysis.

The final VPA run was based on the following options: XSA using the eight quarterly commercial fleets ; tri-cubic down-weighting over 15 years ; age range 1-7+ ; no age treated as recruits ; catchability independent of ages for ages 5 and older ; shrinkage to the mean F using medium SE of 0.5. It should be noted that F shrinkage for the older ages only uses a range of 3 previous ages in order to avoid including partially recruited ages.

Tuning diagnostics (Table 4.1.8) indicate that the Log-catchability residuals (Figure 4.1.1) are generally high for age 1, as observed in previous assessments. The revision of data has not reduced some of the year effects noted for the Lorient fleets, which remain unexplained. The fleets always have a larger weight than shrinkage in the final estimations, contributing 75 to 85 % of the estimates of survivors, depending on age.

4.1.4 VPA results and catch forecasts

Fishing mortalities at age, stock numbers at age and summary results obtained in the final VPA are shown in Table 4.1.9-11 and Figure 4.1.2 a,b. After reaching record high values above 1.0 in 1990 and 1991, fishing mortality has decreased slightly in 1992 and is estimated to have increased again to reach a high level of 0.94 in 1994. Due to the contribution of the very strong 1986 year class, SSB has reached a record value of 19,100 t in 1989 and has subsequently decreased very sharply to 5,300 t in 1992 as an effect of high fishing mortalities and poor recruitment. It is estimated to have increased by 35 % above the historical mean of 7,850 t in 1994 with the contribution of the apparently good 1990 and 1991 year classes.

4.1.5 Yield per recruit and catch forecast

Input data for the predictions are given in Table 4.1.12. The exploitation pattern is based on average fishing mortalities at age in 1992-1994 re-scaled to mean F at ages 2-5 in 1994. Mean weights at age in the catches and in the stock are straight averages for 1992-1994. The estimate of the 1993 year class in 1994 given by the VPA is very large, and seems inconsistent with information available for the Irish Sea stock, in which recruitment patterns of cod are usually similar to those in the Celtic Sea. It was thus decided to replace the estimate of age 1 population in

1994 by the geometric mean recruitment over 1971-1992 (2.5 millions). Numbers at age in 1995 were taken from the VPA except age 2 which was based on GM at age 1 and population ratio. In the absence of any pre-recruit indices, recruitments at age 1 in 1995-1997 were assumed to be equal to the GM estimate.

Results of yield per recruit analysis (Table 4.1.13 and Figure 4.1.2c) indicate that fishing at Fmax (0.29) would imply a 70 % reduction of fishing mortality under the current exploitation pattern, entailing gains in yield of about 32 % under equilibrium conditions. The stock recruitment plot (Figure 4.1.3) indicates that current fishing mortality is above F med (0.8), but is still below F high (1.35).

Assuming *status quo* F, catches are predicted to decrease sharply from 8,520 t in 1994 to 5,600 t in 1995 (-35 %), 5,500 t in 1996 and 5,200 t in 1997 (Table 4.1.14). SSB is estimated to have sharply decreased (6,000 t) in 1995 as the good 1990 and 1991 year classes have been fished out. It is predicted to continue its decline in 1996 (5,500 t) and 1997 (5,000 t), when it will be 50 % below the average of the series. Catches and SSB predicted for a range of fishing mortalities in 1996 are given in the management option Table 4.1.15 and in Figure 4.1.2d. Estimates of the relative contribution of recent year classes to the 1996 landings and 1997 SSB are shown in Table 4.1.16. As expected for early maturing fish, the predicted SSBs are heavily dependent on the assumed value of recruitment for the incoming year-classes.

4.1.6 Comments on the assessment

Despite the revision of the data base, the new resolution of tuning fleets into quarterly series, and the lack of 1994 catch and effort data for one of the main fleets, the results of this assessment are consistent with those obtained last year.

The predictions depend heavily on assumed recruitments, but there are no 0-group surveys for this stock and little prospects that such surveys would be successful. The Cirolana survey data (ages 1-5) were excluded because of large standard errors. The usefulness of this survey may improve as more years with the extended area coverage are added.

This year, missing data that had to be estimated represented 28 % of the total landings, and corresponded to a major component of the Celtic Sea cod fishery. If non-reporting of catches by Division continues for these fleets in future, the ability to provide assessments will be seriously jeopardised.

4.1.7 Management considerations

Catches and SSB of Celtic Sea cod fluctuate considerably, depending on the strength of year-classes. Fishing mortality is very high and, at such levels, the contribution of good year-classes to SSB is very transitory.

The historical minimum SSB (3,660 t in 1976) would be reached in 1997 with a fishing mortality in excess of 1.27, i.e 35 % larger than F in 1994.

Table 4.1.1 Nominal landings of Celtic Sea cod as used by the Working Group in 1995.

Divisions VIIf, VIIg and VIIh

Year	Belgium	France	Ireland	UK (England and Wales)	Others	Total
1973	524	2413	64	196	30	3227
1974	197	1954	24	154		2329
1975	377	2657	15	130	30	3209
1976	226	3535	13	97	1	3872
1977	107	2272	17	62		2458
1978	88	2744	30	69		2931
1979	110	3469	72	86		3737
1980	172	5187	246	209	7	5821
1981	285	7806	108	317		8516
1982	174	6391	142	338		7045
1983	262	7013	274	199		7748
1984	240	4569	204	316		5329
1985	456	5632	198	398		6684
1986	374	7473	226	345		8418
1987	216	7187	380	437		8220
1988	542	12065	612	400		13619
1989	891	14298	1003	482		16674
1990	615	8612	177	689		10093
1991	297	5750	246	590		6883
1992	193	6417	340	655		7605
1993	386	7650	331	604		8971
1994*	398	6727	919	476		8520

* = provisional

Table 4.1.2 **Celtic Sea Cod. LPUE and effort - France, England and Wales**

year	FRANCE				ENGLAND AND WALES											
	lorient Gadoid trawlers in Divisions VIIf,g,h		*Nephrops* trawlers St Guenole+ Loctudy in VIIf,g,h		Otter trawlers in Div. VIIf		Beam trawlers in Div. VIIf		Otter trawlers in Div. VIIg east		Beam trawlers in Div. VIIg east		Otter trawlers in Div. VIIg west		Beam trawlers in Div. VIIg west	
	LPUE(1)	Effort(2)	LPUE(1)	Effort(2)	LPUE(3)	Effort(4)	LPUE(3)	Effort(4)	LPUE(3)	Effort(4)	LPUE(3)	Effort(4)	LPUE(3)	Effort(4)	LPUE(3)	Effort(4)
1972	437.7	2,598			4.60	45,719			5.29	6,007			32.67			
1973	297.6	2,837			2.84	45,280			5.28	3,590			44.48			
1974	331.9	3,580			3.14	38,943			2.39	2,028			0.00			
1975	277.0	3,085			2.10	33,527			3.30	10,347			0.00			
1976	267.0	2,495			1.79	25,608			6.08	5,208			1.89			
1977	177.8	3,587			1.20	27,163			3.75	5,356			4.77			
1978	232.5	3,195			1.69	27,084	0.23	2,499	2.64	6,733			0.00		0.00	
1979	290.9	2,897			2.23	23,844	1.49	1,957	5.05	4,543	0.08	132	0.00		0.00	
1980	412.8	3,284			3.81	26,434	2.94	4,308	4.70	2,671	1.45	96	6.69		0.00	
1981	575.4	3,127			4.84	24,098	3.21	6,240	7.71	7,775	2.91	783	6.49		1.97	
1982	464.8	3,101			4.52	19,201	1.69	9,953	8.84	7,497	1.28	1,858	11.07		0.83	
1983	405.4	4,148			3.01	17,613	1.51	12,353	5.84	5,327	2.50	6,824	0.00		5.54	
1984	620.4	3,749			5.30	23,156	2.30	13,547	6.72	4,352	2.92	4,309	0.00		4.93	
1985	526.3	2,847			7.25	25,236	1.71	18,694	7.91	5,721	2.30	5,144	10.35		2.92	
1986	616.9	3,103	220	4,998	6.40	21,175	2.15	20,724	5.84	7,716	3.00	4,305	7.86		7.07	
1987	658.4	3,479	195	5,445	3.49	24,430	2.49	38,764	3.83	9,866	4.30	4,831	8.21		3.28	
1988	776.1	3,225	365	5,580	5.15	20,092	3.25	25,618	2.79	9,956	2.51	2,183	0.67		6.06	
1989	769.1	3,571	374	6,200	3.64	17,614	2.20	20,255	3.42	8,133	2.30	3,721	1.65		3.38	
1990	491.4	3,559	166	6,701	5.43	22,562	2.83	30,769	5.08	10,549	3.17	4,892	3.34		1.63	
1991	355.2	3,313	121	7,083	5.29	18,573	2.05	40,810	4.89	6,246	3.21	12,388	3.47		2.29	
1992	362.6	3,047	122	7,922	5.87		2.13		2.54		2.76		2.08		2.83	
1993	526.3	2,366	216	8,799	3.83		1.57		5.52		1.99		0.57		2.41	
1994*	n/a	n/a	232	8,139	3.10		1.49		2.30		1.49		2.68		1.58	

(1) LPUE in Kg per 100 hours fishing, power corrected.
(2) Effort in hours fishing x 10**-4, power corrected.
(3) LPUE in Kg / hr.
(4) Effort in hours fishing.

Table 4.1.3 **Celtic Sea Cod : 1994, landings in number at length**

1994	Lorient VIIfgh	St Gué + Loct VIIfgh	France VIIfgh	UK(E+W) VIIfgh	All VIIfgh
Length	estimations		estimations		estimations
25	0	0	0	0	0
26	0	0	0	0	0
27	0	0	0	0	0
28	0	0	0	0	0
29	0	0	0	0	0
30	0	0	0	0	0
31	0	0	0	3	3
32	57	2453	5725	90	6353
33	305	2734	7239	346	8396
34	649	4602	12452	2501	16623
35	1038	6740	18312	4701	25801
36	2752	13960	38049	5804	48718
37	3419	16230	45640	7119	59089
38	3602	22197	58760	6221	71808
39	3992	21694	58931	6994	72968
40	4311	25376	67872	8019	83589
41	4999	22630	62760	6134	76151
42	4379	25624	66576	6056	81500
43	3804	19633	52885	3806	62747
44	3794	22164	57436	6001	70905
45	3762	13822	38840	5469	51030
46	4199	13121	37648	5396	50143
47	5117	11601	38003	7444	54647
48	7242	7564	34471	6575	50227
49	4814	11772	38156	4911	52689
50	6155	10794	39181	4839	54043
51	4134	6386	24121	4189	34170
52	4219	7070	26502	8495	42817
53	4290	3066	17872	3756	26722
54	3514	4116	18611	3265	27274
55	4330	4689	21709	2288	29246
56	3416	3148	15728	2272	22095
57	5017	3154	19997	1688	26800
58	4222	3281	18225	4432	27079
59	4080	3737	18966	1486	24473
60	2965	5483	20434	1251	26048
61	4459	5044	23217	1002	29671
62	3214	3574	16385	3144	23382
63	5042	11411	40424	2055	53081
64	5568	9964	37780	4020	51454
65	8677	9224	43625	2628	58685
66	10486	10184	50640	3249	68399
67	4898	9205	34509	1989	46063
68	5780	6850	30807	2221	41405
69	7984	7955	39227	4188	55388
70	8690	16592	61678	4377	84047
71	7771	15972	58510	3801	80486
72	5787	19379	61842	4882	84460
73	4557	7208	28829	2650	39163
74	4977	15058	49181	2432	65566
75	5700	12150	43789	2935	58272
76	4087	7678	28558	1722	36885
77	4937	5638	25727	1712	33957
78	2894	9152	28941	1628	36288
79	1550	6282	18205	2207	23715
80	3887	6412	24276	1997	31200
81	2291	8208	25475	1338	32734
82	2242	5015	17368	1097	21914
83	2308	4932	17135	1339	22622
84	1915	9394	26521	2117	35248
85	3058	3090	14848	704	19410
86	1052	3191	9699	1467	12894
87	1471	2843	10251	1895	14797
88	1614	7931	22596	816	29008
89	2662	1857	10790	795	14404
90	2126	3489	13728	404	18105
91	1702	746	6006	729	8515
92	1591	3239	11596	532	15152
93	1153	1562	6568	521	8674
94	1744	1391	7551	162	9531
95	848	1896	6227	181	7682
96	230	553	1837	250	2442
97	814	444	2952	208	3829
98	490	329	1933	80	2440
99	96	491	1334	160	1767
100	335	409	1729	0	2070
101	119	1184	3208	47	4144
102	23	548	1232	0	1410
103	573	2070	6515	0	8517
104	276	348	1423	29	1776
105	314	97	1004	58	1330
106	45	649	1592	157	1974
107	37	58	224	0	260
108	51	0	114	0	125
109	52	941	2489	0	3306
110	0	97	228	0	247
111	0	283	703	0	891
112	23	0	46	0	52
113	507	0	1274	0	1703
114	75	0	184	0	220
115	23	0	46	0	52
116	37	0	92	0	110
117	0	0	0	0	0
118	23	0	46	0	52
119	0	0	0	0	0
120	0	0	0	0	0
total	251439	581060	1963820	201477	2595131
Tww	947.2	1859.1	6727	476.4	8520

Table 4.1.4

Run title : Cod, Celtic Sea (run: VPAFIN2/OUF)

At 8-Sep-95 18:45:56

Table 1 Catch numbers at age					Numbers*10**-3
YEAR,	1971,	1972,	1973,	1974,	
AGE					
1,	643,	3,	297,	1,	
2,	409,	647,	214,	199,	
3,	494,	92,	310,	35,	
4,	85,	171,	54,	105,	
5,	31,	38,	66,	34,	
6,	15,	22,	15,	33,	
+gp,	10,	14,	10,	31,	
TOTALNUM,	1687,	987,	966,	438,	
TONSLAND,	4647,	3807,	3227,	2329,	
SOPCOF %,	100,	101,	100,	99,	

Table 1 Catch numbers at age							Numbers*10**-3			
YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	639,	40,	21,	168,	396,	515,	253,	61,	1033,	789,
2,	129,	1145,	353,	424,	323,	1026,	2480,	930,	425,	1015,
3,	176,	48,	200,	110,	238,	241,	652,	714,	434,	105,
4,	58,	84,	13,	99,	62,	148,	123,	136,	341,	71,
5,	100,	9,	51,	17,	94,	44,	33,	29,	62,	66,
6,	19,	18,	2,	29,	17,	47,	16,	15,	17,	16,
+gp,	31,	6,	15,	17,	30,	12,	10,	4,	9,	5,
TOTALNUM,	1152,	1350,	655,	864,	1160,	2033,	3567,	1889,	2321,	2067,
TONSLAND,	3209,	3872,	2458,	2931,	3737,	5821,	8516,	7045,	7748,	5329,
SOPCOF %,	99,	100,	100,	100,	99,	100,	100,	101,	100,	101,

Run title : Cod, Celtic Sea (run: VPAFIN2/OUF)

At 8-Sep-95 18:45:56

Table 1 Catch numbers at age							Numbers*10**-3			
YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	583,	523,	2203,	936,	479,	277,	736,	841,	171,	851,
2,	1000,	1047,	760,	4507,	2198,	790,	959,	2032,	1829,	505,
3,	374,	541,	360,	305,	1991,	791,	179,	290,	817,	999,
4,	49,	204,	201,	116,	134,	489,	228,	48,	73,	195,
5,	32,	24,	50,	34,	68,	57,	129,	59,	22,	22,
6,	38,	25,	16,	16,	17,	23,	28,	38,	21,	7,
+gp,	13,	14,	12,	10,	12,	15,	14,	10,	11,	17,
TOTALNUM,	2089,	2378,	3602,	5924,	4899,	2442,	2273,	3318,	2944,	2596,
TONSLAND,	6683,	8418,	8220,	13619,	16674,	10093,	6883,	7605,	8971,	8520,
SOPCOF %,	101,	100,	98,	100,	100,	100,	100,	100,	100,	100,

Table 4.1.5

Run title : Cod, Celtic Sea (run: VPAFIN2/OUF)

At 8-Sep-95 18:45:56

Table 2 Catch weights at age (kg) YEAR,	1971,	1972,	1973,	1974,
AGE				
1,	.6340,	.6340,	.6340,	.6340,
2,	2.3980,	2.3980,	2.3980,	2.3980,
3,	4.4410,	4.4410,	4.4410,	4.4410,
4,	6.5720,	6.5720,	6.5720,	6.5720,
5,	7.4600,	7.4600,	7.4600,	7.4600,
6,	10.3910,	10.3910,	10.3910,	10.3910,
+gp,	13.5600,	13.1280,	13.2300,	13.6900,
SOPCOFAC,	.9964,	1.0067,	1.0042,	.9935,

Table 2 Catch weights at age (kg) YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	.6340,	.6340,	.6340,	.6340,	.6340,	.6340,	.9450,	.9450,	.9790,	.9410,
2,	2.3980,	2.3980,	2.3980,	2.3980,	2.3980,	2.3980,	1.5490,	2.2420,	2.5250,	2.6400,
3,	4.4410,	4.4410,	4.4410,	4.4410,	4.4410,	4.4410,	4.3850,	4.4740,	4.9610,	5.4470,
4,	6.5720,	6.5720,	6.5720,	6.5720,	6.5720,	6.5720,	7.5650,	7.7970,	7.4570,	7.4510,
5,	7.4600,	7.4600,	7.4600,	7.4600,	7.4600,	7.4600,	9.0600,	10.2500,	9.9650,	8.2400,
6,	10.3910,	10.3910,	10.3910,	10.3910,	10.3910,	10.3910,	12.7500,	12.4650,	12.0100,	9.9200,
+gp,	13.1330,	13.7440,	14.5590,	14.1000,	13.0530,	12.4590,	14.9040,	15.5330,	16.5300,	13.3140,
SOPCOFAC,	.9942,	.9998,	1.0020,	1.0003,	.9940,	1.0043,	.9993,	1.0146,	.9996,	1.0070,

Run title : Cod, Celtic Sea (run: VPAFIN2/OUF)

At 8-Sep-95 18:45:56

Table 2 Catch weights at age (kg) YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	1.0010,	1.0540,	.9090,	.7790,	1.0230,	.8670,	.9630,	.8800,	.9150,	.9620,
2,	2.6370,	2.5540,	2.5040,	2.1510,	2.0670,	2.2280,	2.1460,	1.9110,	2.1190,	2.0970,
3,	5.5210,	5.3980,	5.2640,	5.2130,	4.7900,	4.5090,	4.9830,	5.0120,	4.7130,	4.5110,
4,	8.0820,	7.4400,	8.0890,	7.6730,	7.7430,	7.1330,	6.7020,	7.3440,	7.0280,	8.0280,
5,	10.4070,	10.7820,	10.4470,	10.3360,	9.7670,	9.2860,	9.0630,	9.8320,	8.4570,	10.8180,
6,	11.4690,	12.3960,	13.5740,	11.7390,	12.9960,	12.0300,	11.6840,	11.7330,	11.8640,	11.6130,
+gp,	14.5110,	13.5580,	15.3290,	15.6890,	15.0440,	16.3380,	14.5720,	14.1880,	13.4450,	13.6830,
SOPCOFAC,	1.0066,	.9995,	.9844,	1.0014,	1.0000,	.9987,	.9994,	1.0010,	.9991,	1.0022,

Table 4.1.6

Run title : Cod, Celtic Sea (run: VPAFIN2/OUF)

At 8-Sep-95 18:45:56

Table 3 Stock weights at age (kg)

YEAR,	1971,	1972,	1973,	1974,
AGE				
1,	.4450,	.4450,	.4450,	.4550,
2,	1.4260,	1.4260,	1.4260,	1.4260,
3,	4.3760,	4.3760,	4.3760,	4.3760,
4,	5.8990,	5.8990,	5.8990,	5.8990,
5,	7.8590,	7.8590,	7.8590,	7.8590,
6,	9.8700,	9.8700,	9.8700,	9.8700,
+gp,	11.8150,	11.5500,	11.6140,	11.9090,

Table 3 Stock weights at age (kg)

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	.4550,	.4550,	.4550,	.4550,	.4550,	.4550,	.4600,	.7040,	.4460,	.5120,
2,	1.4260,	1.4260,	1.4260,	1.4260,	1.4260,	1.4260,	1.5490,	1.4880,	1.9450,	1.9670,
3,	4.3760,	4.3760,	4.3760,	4.3760,	4.3760,	4.3760,	2.2840,	3.8760,	4.4670,	4.9480,
4,	5.8990,	5.8990,	5.8990,	5.8990,	5.8990,	5.8990,	7.8060,	7.4070,	7.3530,	6.6730,
5,	7.8590,	7.8590,	7.8590,	7.8590,	7.8590,	7.8590,	10.5440,	9.6240,	9.7520,	7.0360,
6,	9.8700,	9.8700,	9.8700,	9.8700,	9.8700,	9.8700,	11.4390,	12.3160,	11.2230,	8.2110,
+gp,	11.5520,	11.9310,	12.4490,	12.0630,	11.4810,	11.1400,	14.6420,	15.9160,	17.5520,	10.6790,

Run title : Cod, Celtic Sea (run: VPAFIN2/OUF)

At 8-Sep-95 18:45:56

Table 3 Stock weights at age (kg)

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	.5810,	.5280,	.5220,	.6170,	.7200,	.7340,	.4850,	.5000,	.5000,	.5520,
2,	2.0700,	1.9020,	1.9470,	1.6480,	1.5080,	1.7690,	1.5680,	1.4410,	1.5360,	1.6120,
3,	5.3330,	5.2860,	4.8770,	5.0380,	4.5360,	4.2580,	4.8420,	4.6040,	4.5230,	4.1320,
4,	8.3760,	7.3820,	7.9460,	8.0560,	7.6910,	7.2670,	6.6600,	6.8570,	7.0780,	7.8890,
5,	10.8510,	10.6890,	10.3080,	10.8040,	9.9660,	9.4220,	9.0890,	9.6030,	9.8010,	11.7750,
6,	11.5850,	12.3930,	14.4190,	11.7290,	12.6090,	10.8500,	11.5210,	11.5760,	12.1750,	11.3290,
+gp,	15.0860,	14.4820,	15.4290,	14.7960,	16.3740,	14.9750,	14.3460,	13.8630,	13.9690,	13.8750,

Table 4.1.7

09:54 Wednesday, September 6, 1995

COD-CELT: Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

FLT08: ZE Q1 French Lorient gadoids trawlers (FE*10**-3)

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1983	122.698	1.8	14.3	39.1	45.7	9.3	2.9	0.5
1984	103.600	2.9	94.9	15.1	16.7	29.8	6.3	0.6
1985	68.026	0.0	63.3	58.8	3.9	3.2	3.9	0.9
1986	96.173	1.3	41.8	128.2	69.5	4.5	6.0	2.0
1987	97.554	1.5	39.0	33.4	71.2	9.7	2.2	1.2
1988	74.662	10.3	318.9	31.7	14.6	8.9	2.6	0.0
1989	106.180	0.0	169.8	262.1	11.1	4.5	1.4	0.1
1990	80.372	0.0	23.5	82.8	62.0	4.6	0.3	1.5
1991	86.088	1.5	36.9	14.1	25.5	16.0	2.4	0.9
1992	89.728	0.0	152.6	16.2	4.3	4.8	4.3	1.0
1993	65.910	0.0	110.3	108.9	2.7	1.4	0.8	0.3

COD-CELT: Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

FLT09: ZE Q2 French Lorient gadoids trawlers(FE*10**-3)

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1983	108.041	11.6	23.1	23.1	20.6	2.6	1.0	0.4
1984	100.404	69.1	151.0	10.8	10.3	6.4	1.8	0.5
1985	71.276	9.4	76.7	28.4	2.7	2.6	2.0	0.5
1986	84.009	13.5	71.8	55.7	12.5	1.4	1.9	2.2
1987	93.041	42.2	68.5	26.0	7.0	2.7	0.3	0.4
1988	97.475	18.7	324.6	9.9	6.4	1.9	1.5	0.0
1989	111.053	0.4	95.8	96.3	4.5	2.6	1.1	0.3
1990	115.966	12.2	38.4	39.6	25.6	3.0	1.4	0.1
1991	103.040	7.5	37.9	5.8	16.3	10.6	2.7	0.4
1992	74.178	0.7	62.3	7.8	0.8	1.3	1.5	0.2
1993	61.626	0.0	71.2	11.6	1.8	0.3	0.6	0.3

COD-CELT: Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

FLT10: ZE Q3 French Lorient gadoids trawlers(FE*10**-3)

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1983	81.283	123.1	35.4	27.1	8.2	2.3	0.1	0.1
1984	86.040	159.6	151.2	10.6	4.8	3.1	0.9	0.1
1985	61.776	32.0	38.1	11.0	1.1	0.5	1.0	0.5
1986	71.682	26.1	54.5	7.1	3.1	0.6	0.5	0.2
1987	69.553	316.8	51.5	19.9	1.1	0.7	0.2	0.1
1988	56.959	44.2	147.3	8.1	3.0	0.3	0.2	0.0
1989	62.735	27.0	103.3	49.5	2.4	1.3	0.1	0.1
1990	101.788	25.5	59.7	30.3	11.6	1.2	0.3	0.0
1991	58.790	37.3	50.8	4.1	1.7	1.2	0.3	0.1
1992	62.674	53.4	57.7	6.5	0.9	1.1	0.7	0.1
1993	43.152	7.5	46.4	6.7	0.9	0.5	0.2	0.1

COD-CELT: Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

FLT11: ZE Q4 French Lorient gadoids trawlers(FE*10**-3)

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1983	102.789	78.6	13.5	9.7	6.9	1.4	0.4	0.0
1984	84.814	90.1	34.0	7.1	2.8	2.5	0.4	0.1
1985	83.581	42.1	32.4	10.5	3.6	1.6	2.8	0.1
1986	58.441	27.4	18.3	5.6	1.0	0.2	0.2	0.0
1987	87.737	315.8	23.9	12.2	2.4	1.0	0.3	0.1
1988	93.443	107.7	102.7	5.3	2.9	0.9	0.2	0.1
1989	77.092	34.2	27.5	20.1	2.1	0.7	0.3	0.1
1990	57.811	11.7	11.8	7.3	5.7	1.5	0.6	0.1
1991	83.425	83.3	17.4	2.3	2.3	1.1	0.2	0.1
1992	78.151	115.6	45.7	4.5	0.7	0.9	0.2	0.0
1993	65.939	20.4	43.3	3.6	1.0	0.5	0.2	0.1

Table 4.1.7 (cont'd.)

COD-CELT: Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

FLT18: ZE Q1 Nephrops trawlers St Guenole+Loctudy(FE*10**-3)

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1987	124.097	0.4	22.9	15.9	15.1	4.3	1.6	0.4
1988	112.781	2.7	121.8	13.9	4.6	3.1	1.4	0.6
1989	131.911	0.0	100.2	126.8	10.4	5.3	1.6	0.4
1990	106.236	0.0	13.8	22.2	12.0	1.5	0.1	0.7
1991	156.705	0.3	26.1	7.6	10.3	5.6	1.4	1.5
1992	183.839	0.0	87.9	9.5	2.4	2.5	1.8	0.6
1993	227.000	0.0	90.1	79.8	5.1	0.5	2.6	0.5
1994	166.447	0.2	20.8	111.3	15.5	2.1	0.1	1.6

COD-CELT: Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

FLT19: ZE Q2 Nephrops trawlers St Guenole+Loctudy(FE*10**-3)

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1987	135.257	3.0	34.6	14.9	4.2	1.5	0.9	0.3
1988	152.126	5.9	252.9	20.9	4.6	1.4	0.8	0.3
1989	186.653	1.0	102.9	69.2	4.3	3.1	0.4	0.5
1990	198.263	4.8	39.0	32.7	18.0	2.1	0.8	0.1
1991	211.212	0.9	46.7	7.0	9.2	4.3	1.1	0.5
1992	206.026	2.6	135.7	13.0	1.1	4.0	1.7	0.3
1993	236.835	0.0	141.7	34.6	4.1	0.3	1.1	0.5
1994	192.641	12.5	23.7	40.1	11.1	0.9	0.5	0.2

COD-CELT: Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

FLT20: ZE Q3 Nephrops trawlers St Guenole+Loctudy(FE*10**-3)

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1987	157.748	58.1	37.2	15.4	1.5	1.4	0.6	1.3
1988	147.380	12.4	152.3	19.9	5.9	0.7	0.6	0.5
1989	164.079	8.0	49.8	43.1	6.8	3.9	0.3	0.9
1990	197.472	3.7	29.4	25.4	13.6	1.8	1.0	0.5
1991	180.127	21.9	48.0	8.3	3.2	2.7	1.3	0.7
1992	208.134	68.1	61.8	21.6	2.2	1.1	0.5	0.9
1993	204.873	1.6	98.2	17.6	5.3	2.0	1.0	0.6
1994	216.766	131.1	27.5	29.2	6.1	0.9	0.1	0.4

COD-CELT: Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

FLT21: ZE Q4 Nephrops trawlers St Guenole+Loctudy(FE*10**-3)

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1987	127.381	60.9	12.4	7.2	3.1	1.2	1.4	0.3
1988	145.736	21.0	83.3	8.0	3.6	1.2	0.4	0.2
1989	137.327	10.2	28.3	30.2	3.8	1.5	0.5	0.2
1990	167.797	9.8	11.1	11.1	7.4	2.0	1.9	0.0
1991	157.828	38.2	13.2	3.5	2.6	1.2	0.5	0.1
1992	194.177	47.0	39.1	14.9	1.1	1.3	1.0	0.0
1993	211.178	12.7	46.9	16.5	3.0	0.6	0.4	0.4
1994	238.102	115.1	5.5	17.3	5.9	0.8	0.2	0.1

COD-CELT: Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

FLT29: UK (E+W) PHHT GFS, Eff in mn,Numb*10**2

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5
1987	100	24.6	15.2	19.3	0.0	1.6
1988	100	6.0	50.2	6.0	0.0	0.0
1989	100	0.0	23.6	47.6	36.1	5.3
1990	100	3.5	7.0	34.0	20.1	10.5
1991	100	20.3	26.2	8.5	1.7	8.5
1992	100	41.9	106.9	5.2	3.0	3.0
1993	100	7.9	115.0	78.6	21.2	1.6
1994	100	233.3	24.2	98.5	32.2	9.1
1995	100	350.3	432.0	24.3	56.7	20.0

Table 4.1.8

Extended Survivors Analysis

Cod, Celtic Sea (run: VPAFIN2/OUF)

CPUE data from file /users/fish/ifad/ifapwork/wgssds/cod_celt/FLEET.OUF

Catch data for 24 years. 1971 to 1994. Ages 1 to 7.

Fleet,	First, year,	Last, year,	First, age,	Last, age	Alpha,	Beta
FLT08: ZE Q1 French ,	1983,	1994,	1,	6,	.000,	.250
FLT09: ZE Q2 French ,	1983,	1994,	1,	6,	.250,	.500
FLT10: ZE Q3 French ,	1983,	1994,	1,	6,	.500,	.750
FLT11: ZE Q4 French ,	1983,	1994,	1,	6,	.750,	1.000
FLT18: ZE Q1 Nephrop,	1987,	1994,	1,	6,	.000,	.250
FLT19: ZE Q2 Nephrop,	1987,	1994,	1,	6,	.250,	.500
FLT20: ZE Q3 Nephrop,	1987,	1994,	1,	6,	.500,	.750
FLT21: ZE Q4 Nephrop,	1987,	1994,	1,	6,	.750,	1.000

Time series weights :

Tapered time weighting applied
Power = 3 over 15 years

Catchability analysis :

Catchability independent of stock size for all ages

Catchability independent of age for ages >= 5

Terminal population estimation :

Survivor estimates shrunk towards the mean F
of the final 5 years or the 3 oldest ages.

S.E. of the mean to which the estimates are shrunk = .500

Minimum standard error for population
estimates derived from each fleet = .300

Prior weighting not applied

Tuning converged after 35 iterations

Log catchability residuals.

Fleet : FLT08: ZE Q1 French

Age ,	1983,	1984
1 ,	-.19,	.47
2 ,	-.82,	.25
3 ,	-.42,	-.31
4 ,	-.14,	.11
5 ,	-.10,	.70
6 ,	.20,	.60

Age ,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994
1 ,	99.99,	.07,	-1.42,	1.57,	99.99,	99.99,	-.43,	99.99,	99.99,	99.99
2 ,	.19,	-.44,	-.35,	.39,	.19,	-.30,	-.21,	.30,	.23,	99.99
3 ,	.38,	.69,	-.41,	-.15,	.16,	.13,	-.28,	-.60,	.61,	99.99
4 ,	-.51,	1.12,	1.27,	-.02,	-.69,	.35,	.14,	-.37,	-.84,	99.99
5 ,	-.38,	.07,	.38,	.87,	-.65,	-.35,	.26,	-.28,	-.15,	99.99
6 ,	-.28,	.57,	.10,	.27,	-.42,	-1.97,	-.13,	.10,	-.65,	99.99

Table 4.1.8 (cont'd.)

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age ,	1,	2,	3,	4,	5,	6
Mean Log q,	-12.2003,	-7.9007,	-7.1569,	-7.1603,	-7.2184,	-7.2184,
S.E(Log q),	1.1765,	.3419,	.4495,	.7021,	.4823,	.8204,

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
1,	9.55,	-.673,	42.73,	.00,	6,	12.57,	-12.20,
2,	.69,	4.183,	7.90,	.97,	11,	.13,	-7.90,
3,	.73,	1.843,	7.04,	.88,	11,	.28,	-7.16,
4,	.65,	1.494,	6.61,	.75,	11,	.42,	-7.16,
5,	.96,	.115,	7.11,	.57,	11,	.50,	-7.22,
6,	.73,	.424,	6.50,	.29,	11,	.60,	-7.49,

Fleet : FLT09: ZE Q2 French

Age ,	1983,	1984
1 ,	.65,	2.49
2 ,	-.13,	.80
3 ,	.22,	.29
4 ,	.25,	.63
5 ,	-.21,	.15
6 ,	.34,	.34

Age ,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994
1 ,	.98,	1.36,	.77,	.70,	-2.17,	1.03,	-.21,	-2.29,	99.99,	99.99
2 ,	.36,	.30,	.30,	.20,	-.33,	-.02,	-.25,	-.33,	-.10,	99.99
3 ,	.54,	1.00,	.35,	-.65,	.17,	.06,	-.34,	-.10,	-.51,	99.99
4 ,	.05,	.64,	.14,	-.12,	-.63,	.21,	.62,	-.83,	-.11,	99.99
5 ,	.32,	.01,	.19,	.08,	-.17,	-.12,	.77,	-.32,	-.53,	99.99
6 ,	-.03,	.58,	-.80,	.45,	.37,	.28,	.90,	.33,	.22,	99.99

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age ,	1,	2,	3,	4,	5,	6
Mean Log q,	-10.9044,	-7.7132,	-7.8749,	-7.9519,	-8.0141,	-8.0141,
S.E(Log q),	1.5858,	.3210,	.4835,	.5195,	.3957,	.5394,

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
1,	.91,	.082,	10.68,	.15,	10,	1.58,	-10.90,
2,	1.06,	-.259,	7.70,	.79,	11,	.36,	-7.71,
3,	.90,	.408,	7.76,	.74,	11,	.46,	-7.87,
4,	.70,	1.626,	7.25,	.83,	11,	.33,	-7.95,
5,	.66,	2.355,	6.87,	.89,	11,	.20,	-8.01,
6,	.81,	.483,	6.97,	.51,	11,	.38,	-7.72,

Table 4.1.8 (cont'd.)

Fleet : FLT10: ZE Q3 French

Age	1983	1984
1	1.00	1.17
2	.38	.72
3	.86	.49
4	.27	.57
5	.53	.08
6	-1.05	.30

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	.02	-.15	.74	-.25	.30	-.46	-.39	-.13	-.20	99.99
2	-.45	-.03	.05	-.26	.12	.42	.44	-.45	-.41	99.99
3	-.17	-.74	.49	-.22	.30	.11	.04	.08	-.50	99.99
4	-.14	.09	-.68	.24	-.08	.25	-.39	.07	.20	99.99
5	-.68	-.15	-.29	-.67	.33	-.34	-.21	.29	.98	99.99
6	-.07	-.02	-.32	-.49	-.84	-.50	-.10	.37	.12	99.99

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	1	2	3	4	5	6
Mean Log q	-8.4670	-7.2432	-7.7542	-8.3315	-8.3562	-8.3562
S.E(Log q)	.4829	.3972	.4067	.3357	.5354	.4727

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
1	.84	.724	8.42	.77	11	.42	-8.47
2	1.68	-2.146	6.80	.62	11	.54	-7.24
3	1.06	-.252	7.82	.74	11	.46	-7.75
4	1.03	-.137	8.41	.79	11	.37	-8.33
5	1.70	-1.107	10.95	.30	11	.89	-8.36
6	.59	1.819	6.61	.77	11	.21	-8.56

Fleet : FLT11: ZE Q4 French

Age	1983	1984
1	.19	.46
2	.14	.16
3	.41	.77
4	.09	.17
5	-.08	-.09
6	.28	-.45

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	-.17	-.05	.34	-.02	.18	-.85	-.11	.25	.19	99.99
2	-.01	.03	-.03	-.17	-.44	.40	.02	.06	.01	99.99
3	.19	.00	.50	-.44	.02	.06	-.11	.30	-.73	99.99
4	.87	-.59	.17	-.13	-.25	.38	-.17	-.21	.10	99.99
5	.22	-.98	-.04	.04	-.34	.56	-.46	.03	.73	99.99
6	.71	-.62	.00	-.90	.22	.92	-.68	-.93	-.12	99.99

Table 4.1.8 (cont'd.)

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age ,	1,	2,	3,	4,	5,	6
Mean Log q,	-8.1991,	-7.9345,	-8.2441,	-8.2810,	-8.2398,	-8.2398,
S.E(Log q),	.3797,	.2291,	.4196,	.3580,	.5017,	.6967,

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
1,	.88,	.630,	8.20,	.82,	11,	.35,	-8.20,
2,	1.28,	-1.929,	7.94,	.89,	11,	.25,	-7.93,
3,	1.21,	-.775,	8.56,	.69,	11,	.52,	-8.24,
4,	.97,	.123,	8.21,	.79,	11,	.38,	-8.28,
5,	1.64,	-1.130,	10.56,	.34,	11,	.81,	-8.24,
6,	1.38,	-.365,	10.17,	.14,	11,	.98,	-8.43,

Fleet : FLT18: ZE Q1 Nephrop

Age ,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994
1 ,	99.99,	99.99,	-.53,	2.27,	99.99,	99.99,	-.19,	99.99,	99.99,	-1.29
2 ,	99.99,	99.99,	-.13,	.00,	.44,	-.12,	-.17,	.02,	-.21,	.17
3 ,	99.99,	99.99,	-.18,	-.17,	.43,	-.25,	-.28,	-.63,	.28,	.74
4 ,	99.99,	99.99,	.76,	-.30,	.31,	-.28,	-.08,	-.39,	-.15,	.31
5 ,	99.99,	99.99,	.63,	.70,	.60,	-.45,	-.09,	-.35,	-1.11,	.40
6 ,	99.99,	99.99,	.84,	.54,	.80,	-2.05,	.03,	-.18,	.59,	-1.22

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age ,	1,	2,	3,	4,	5,	6
Mean Log q,	-14.6510,	-8.8922,	-8.3715,	-8.4437,	-8.5180,	-8.5180,
S.E(Log q),	1.5571,	.2180,	.4651,	.3823,	.6561,	1.0615,

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
1,	-.82,	-.934,	4.36,	.15,	4,	1.31,	-14.65,
2,	.97,	.228,	8.86,	.93,	8,	.23,	-8.89,
3,	.68,	2.666,	7.89,	.93,	8,	.23,	-8.37,
4,	.89,	.513,	8.13,	.80,	8,	.36,	-8.44,
5,	.80,	.527,	7.73,	.57,	8,	.56,	-8.52,
6,	.69,	.546,	7.06,	.36,	8,	.77,	-8.65,

Fleet : FLT19: ZE Q2 Nephrop

Age ,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994
1 ,	99.99,	99.99,	-.63,	.72,	-.16,	1.18,	-1.42,	-.37,	99.99,	.65
2 ,	99.99,	99.99,	-.08,	.18,	-.11,	.13,	-.08,	.10,	-.08,	-.05
3 ,	99.99,	99.99,	.06,	.30,	-.03,	-.02,	-.22,	.03,	-.12,	.06
4 ,	99.99,	99.99,	.10,	-.05,	-.35,	.17,	.17,	-.70,	.20,	.45
5 ,	99.99,	99.99,	.09,	.19,	.35,	-.15,	.01,	.64,	-1.02,	-.01
6 ,	99.99,	99.99,	.79,	.24,	-.30,	.04,	.14,	.29,	.34,	.91

Table 4.1.8 (cont'd.)

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age ,	1,	2,	3,	4,	5,	6
Mean Log q,	-12.5264,	-8.3873,	-8.5215,	-8.7923,	-8.8743,	-8.8743,
S.E(Log q),	.9248,	.1153,	.1521,	.3762,	.5017,	.5063,

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
1,	1.46,	-.499,	14.33,	.22,	7,	1.45,	-12.53,
2,	.96,	.750,	8.36,	.98,	8,	.11,	-8.39,
3,	.98,	.251,	8.49,	.96,	8,	.16,	-8.52,
4,	.76,	1.570,	8.03,	.89,	8,	.26,	-8.79,
5,	.68,	1.525,	7.49,	.81,	8,	.31,	-8.87,
6,	1.71,	-1.599,	12.14,	.48,	8,	.60,	-8.57,

Fleet : FLT20: ZE Q3 Nephrop

Age ,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994
1 ,	99.99,	99.99,	.31,	-.38,	.21,	-.96,	.05,	1.00,	-1.22,	.98
2 ,	99.99,	99.99,	.06,	-.03,	-.43,	.20,	.41,	-.43,	-.08,	.28
3 ,	99.99,	99.99,	-.01,	.30,	-.23,	-.15,	.20,	.65,	-.52,	-.23
4 ,	99.99,	99.99,	-.88,	.28,	.30,	.06,	-.57,	.07,	.72,	-.14
5 ,	99.99,	99.99,	-.13,	-.49,	.75,	-.31,	-.23,	-.62,	1.09,	-.13
6 ,	99.99,	99.99,	.25,	-.05,	-.41,	.32,	.53,	-.88,	.45,	-.74

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age ,	1,	2,	3,	4,	5,	6
Mean Log q,	-10.5555,	-8.3897,	-8.3288,	-8.6384,	-8.6413,	-8.6413,
S.E(Log q),	.8469,	.3168,	.3823,	.4981,	.6193,	.5747,

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
1,	.57,	2.511,	9.62,	.86,	8,	.36,	-10.56,
2,	1.39,	-2.133,	8.61,	.85,	8,	.35,	-8.39,
3,	1.59,	-2.456,	9.19,	.76,	8,	.46,	-8.33,
4,	1.39,	-.940,	9.82,	.52,	8,	.70,	-8.64,
5,	1.79,	-1.071,	11.88,	.26,	8,	1.09,	-8.64,
6,	.78,	.621,	7.60,	.60,	8,	.47,	-8.72,

Fleet : FLT21: ZE Q4 Nephrop

Age ,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994
1 ,	99.99,	99.99,	.00,	-.42,	.08,	-.42,	.15,	.12,	.24,	.16
2 ,	99.99,	99.99,	-.04,	.20,	.04,	.30,	.13,	.02,	-.05,	-.55
3 ,	99.99,	99.99,	-.12,	-.19,	.13,	-.31,	-.04,	.86,	-.09,	-.31
4 ,	99.99,	99.99,	.40,	-.02,	.11,	-.08,	-.34,	-.33,	.38,	-.01
5 ,	99.99,	99.99,	.16,	.27,	.23,	.18,	-.62,	-.12,	.14,	-.12
6 ,	99.99,	99.99,	1.55,	-.26,	.54,	1.40,	-.01,	.16,	-.21,	.16

Table 4.1.8 (cont'd.)

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age ,	1,	2,	3,	4,	5,	6
Mean Log q,	-9.8813,	-8.9613,	-8.5243,	-8.6257,	-8.6295,	-8.6295,
S.E(Log q),	.2602,	.2636,	.3952,	.2791,	.3034,	.7942,

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
1,	1.00,	.000,	9.88,	.91,	8,	.28,	-9.88,
2,	.87,	1.089,	8.82,	.93,	8,	.23,	-8.96,
3,	1.21,	-.802,	8.87,	.73,	8,	.49,	-8.52,
4,	1.03,	-.159,	8.71,	.84,	8,	.31,	-8.63,
5,	1.31,	-1.184,	9.88,	.74,	8,	.38,	-8.63,
6,	1.04,	-.076,	8.45,	.36,	8,	.77,	-8.25,

Terminal year survivor and F summaries :

Age 1 Catchability constant w.r.t. time and dependent on age

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT08: ZE Q1 French ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT09: ZE Q2 French ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT10: ZE Q3 French ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT11: ZE Q4 French ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT18: ZE Q1 Nephrop,	2141.,	1.764,	.000,	.00,	1,	.018,	.307
FLT19: ZE Q2 Nephrop,	14870.,	.995,	.000,	.00,	1,	.056,	.050
FLT20: ZE Q3 Nephrop,	20786.,	.903,	.000,	.00,	1,	.068,	.036
FLT21: ZE Q4 Nephrop,	9112.,	.300,	.000,	.00,	1,	.615,	.081
F shrinkage mean ,	3754.,	.50,,,,				.243,	.187

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
7780.,	.24,	.28,	5,	1.185,	.094

Age 2 Catchability constant w.r.t. time and dependent on age

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT08: ZE Q1 French ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT09: ZE Q2 French ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT10: ZE Q3 French ,	218.,	.512,	.000,	.00,	1,	.045,	1.129
FLT11: ZE Q4 French ,	325.,	.403,	.000,	.00,	1,	.073,	.877
FLT18: ZE Q1 Nephrop,	318.,	.300,	.000,	.00,	1,	.155,	.890
FLT19: ZE Q2 Nephrop,	255.,	.300,	.000,	.00,	1,	.155,	1.027
FLT20: ZE Q3 Nephrop,	303.,	.317,	.463,	1.46,	2,	.136,	.920
FLT21: ZE Q4 Nephrop,	222.,	.213,	.393,	1.85,	2,	.286,	1.118
F shrinkage mean ,	291.,	.50,,,,				.151,	.943

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
268.,	.13,	.11,	9,	.844,	.996

Table 4.1.8 (cont'd.)

Age 3 Catchability constant w.r.t. time and dependent on age

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT08: ZE Q1 French ,	531.,	.363,	.000,	.00,	1,	.044,	.994
FLT09: ZE Q2 French ,	355.,	.334,	.388,	1.16,	2,	.051,	1.266
FLT10: ZE Q3 French ,	308.,	.327,	.138,	.42,	2,	.050,	1.369
FLT11: ZE Q4 French ,	458.,	.242,	.112,	.46,	2,	.093,	1.089
FLT18: ZE Q1 Nephrop,	510.,	.273,	.474,	1.74,	2,	.111,	1.019
FLT19: ZE Q2 Nephrop,	423.,	.220,	.064,	.29,	3,	.197,	1.143
FLT20: ZE Q3 Nephrop,	377.,	.266,	.182,	.68,	3,	.126,	1.223
FLT21: ZE Q4 Nephrop,	383.,	.204,	.125,	.62,	3,	.182,	1.212
F shrinkage mean ,	464.,	.50,,,,				.146,	1.082

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
420.,	.11,	.06,	19,	.565,	1.147

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT08: ZE Q1 French ,	191.,	.310,	.149,	.48,	3,	.040,	.654
FLT09: ZE Q2 French ,	79.,	.307,	.067,	.22,	3,	.038,	1.170
FLT10: ZE Q3 French ,	76.,	.288,	.029,	.10,	3,	.046,	1.202
FLT11: ZE Q4 French ,	89.,	.235,	.259,	1.10,	3,	.060,	1.092
FLT18: ZE Q1 Nephrop,	156.,	.289,	.065,	.22,	4,	.138,	.757
FLT19: ZE Q2 Nephrop,	149.,	.240,	.178,	.74,	4,	.178,	.783
FLT20: ZE Q3 Nephrop,	90.,	.304,	.103,	.34,	4,	.106,	1.086
FLT21: ZE Q4 Nephrop,	121.,	.220,	.031,	.14,	4,	.243,	.901
F shrinkage mean ,	121.,	.50,,,,				.151,	.899

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
121.,	.12,	.06,	29,	.483,	.899

Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT08: ZE Q1 French ,	10.,	.369,	.168,	.46,	3,	.031,	1.080
FLT09: ZE Q2 French ,	17.,	.347,	.061,	.18,	4,	.042,	.787
FLT10: ZE Q3 French ,	22.,	.272,	.084,	.31,	4,	.080,	.636
FLT11: ZE Q4 French ,	20.,	.262,	.141,	.54,	4,	.079,	.688
FLT18: ZE Q1 Nephrop,	19.,	.314,	.192,	.61,	4,	.101,	.722
FLT19: ZE Q2 Nephrop,	20.,	.265,	.064,	.24,	5,	.147,	.685
FLT20: ZE Q3 Nephrop,	25.,	.341,	.207,	.61,	5,	.091,	.583
FLT21: ZE Q4 Nephrop,	20.,	.213,	.148,	.70,	5,	.284,	.683
F shrinkage mean ,	13.,	.50,,,,				.145,	.908

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
19.,	.12,	.06,	35,	.481,	.719

Table 4.1.8 (cont'd.)

Age 6 Catchability constant w.r.t. time and age (fixed at the value for age) 5

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT08: ZE Q1 French ,	3.,	.358,	.050,	.14,	4,	.048,	1.194
FLT09: ZE Q2 French ,	2.,	.306,	.097,	.32,	5,	.069,	1.440
FLT10: ZE Q3 French ,	5.,	.274,	.217,	.79,	5,	.068,	.797
FLT11: ZE Q4 French ,	4.,	.270,	.220,	.81,	5,	.070,	.901
FLT18: ZE Q1 Nephrop,	2.,	.366,	.213,	.58,	5,	.068,	1.600
FLT19: ZE Q2 Nephrop,	4.,	.300,	.370,	1.23,	6,	.150,	.968
FLT20: ZE Q3 Nephrop,	3.,	.374,	.314,	.84,	6,	.104,	1.176
FLT21: ZE Q4 Nephrop,	3.,	.230,	.094,	.41,	6,	.169,	1.040
F shrinkage mean ,	4.,	.50,,,,				.253,	.932

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
3.,	.15,	.08,	43,	.556,	1.053

Table 4.1.9

Run title : Cod, Celtic Sea (run: VPAFIN2/OUF)

At 8-Sep-95 18:45:56

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1971,	1972,	1973,	1974,
AGE				
1,	.3058,	.0065,	.2546,	.0025,
2,	.8132,	.5792,	.8407,	.2709,
3,	.7175,	.4229,	.6147,	.3055,
4,	.6094,	.5863,	.4738,	.4328,
5,	.3953,	.6131,	.4715,	.6275,
6,	.5790,	.5452,	.5242,	.4586,
+gp,	.5790,	.5452,	.5242,	.4586,
FBAR 2- 5,	.6339,	.5504,	.6002,	.4092,

Table 8 Fishing mortality (F) at age YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	.2443,	.0445,	.0160,	.1400,	.1353,	.0955,	.1129,	.0658,	.3607,	.2698,
2,	.5115,	.9306,	.6736,	.5084,	.4353,	.6135,	.8903,	.7694,	.8656,	.7365,
3,	.4097,	.3616,	.3971,	.4556,	.6056,	.6873,	1.0711,	.7030,	1.0799,	.5368,
4,	1.2849,	.3498,	.1556,	.3491,	.5063,	1.0003,	.9574,	.6710,	.9035,	.4919,
5,	.9939,	.6841,	.3718,	.3133,	.6628,	.8470,	.6314,	.6201,	.7601,	.4263,
6,	.9058,	.4687,	.3100,	.3751,	.5967,	.8537,	.8962,	.6708,	.9550,	.4445,
+gp,	.9058,	.4687,	.3100,	.3751,	.5967,	.8537,	.8962,	.6708,	.9550,	.4445,
FBAR 2- 5,	.8000,	.5815,	.3995,	.4066,	.5525,	.7870,	.8875,	.6909,	.9023,	.5479,

Run title : Cod, Celtic Sea (run: VPAFIN2/OUF)

At 8-Sep-95 18:45:56

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	FBAR 92-94
AGE											
1,	.2275,	.2458,	.2024,	.1889,	.2947,	.1408,	.1580,	.1743,	.1611,	.0944,	.1433,
2,	.6529,	.8220,	.6824,	.8223,	.9071,	1.1725,	1.0195,	.8608,	.7046,	.9957,	.8537,
3,	.6733,	.9381,	.7667,	.6533,	1.1657,	1.0478,	.9601,	1.0625,	1.1098,	1.1473,	1.1065,
4,	.5191,	1.0216,	1.2231,	.6044,	.6826,	1.0858,	1.0549,	.7508,	.8727,	.8986,	.8407,
5,	.4304,	.5228,	.7596,	.6839,	.9024,	.7107,	1.0001,	.8955,	.9841,	.7193,	.8663,
6,	.4681,	.7201,	.8190,	.5880,	.9150,	.9301,	.9708,	.9632,	.9935,	1.0530,	1.0032,
+gp,	.4681,	.7201,	.8190,	.5880,	.9150,	.9301,	.9708,	.9632,	.9935,	1.0530,	
FBAR 2- 5,	.5689,	.8261,	.8579,	.6910,	.9145,	1.0042,	1.0087,	.8924,	.9178,	.9402,	

Table 4.1.10

Run title : Cod, Celtic Sea (run: VPAFIN2/OUF)

At 8-Sep-95 18:45:56

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year)					Numbers*10**-3
YEAR,	1971,	1972,	1973,	1974,	
AGE					
1,	2697,	511,	1460,	436,	
2,	812,	1626,	416,	927,	
3,	1066,	295,	746,	147,	
4,	206,	426,	158,	330,	
5,	105,	92,	194,	81,	
6,	38,	58,	41,	99,	
+gp,	25,	36,	27,	92,	
TOTAL,	4949,	3044,	3042,	2112,	

Table 10 Stock number at age (start of year)							Numbers*10**-3			
YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	3258,	1016,	1459,	1421,	3458,	6248,	2619,	1058,	3770,	3687,
2,	356,	2089,	796,	1176,	1011,	2473,	4650,	1915,	811,	2152,
3,	579,	175,	674,	332,	579,	536,	1096,	1563,	726,	279,
4,	89,	315,	100,	371,	172,	259,	221,	308,	634,	202,
5,	175,	20,	182,	70,	214,	85,	78,	69,	129,	210,
6,	35,	53,	8,	102,	42,	90,	30,	34,	31,	49,
+gp,	57,	18,	62,	60,	73,	23,	18,	9,	16,	15,
TOTAL,	4549,	3686,	3281,	3532,	5550,	9714,	8711,	4955,	6116,	6596,

Run title : Cod, Celtic Sea (run: VPAFIN2/OUF)

At 8-Sep-95 18:45:56

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year)								Numbers*10**-3					
YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	GMST 71-92	AMST 71-92
AGE													
1,	3166,	2652,	13288,	6010,	2074,	2331,	5566,	5812,	1270,	(10443),	0,	2491,	3364,
2,	2305,	2065,	1698,	8886,	4074,	1265,	1658,	3891,	3997,	885,	(7780),	1604,	2139,
3,	844,	982,	743,	703,	3197,	1346,	321,	490,	1347,	1618,	268,	617,	792,
4,	134,	352,	315,	283,	299,	816,	387,	100,	139,	364,	420,	253,	294,
5,	101,	65,	104,	76,	126,	124,	226,	110,	39,	47,	121,	106,	120,
6,	112,	54,	32,	40,	31,	42,	50,	68,	37,	12,	19,	45,	52,
+gp,	38,	30,	23,	25,	22,	27,	24,	18,	19,	28,	11,		
TOTAL,	6700,	6200,	16203,	16021,	9823,	5951,	8231,	10488,	6847,	13396,	8619,		

(): age 1 replaced by GM ; age 2 based on population ratio.

Table 4.1.11

Run title : Cod, Celtic Sea (run: VPAFIN2/OUF)

At 8-Sep-95 18:45:56

Table 16 Summary (Without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 2- 5,
1971,	2697,	9729,	7429,	4647,	.6255,	.6339,
1972,	511,	8062,	5631,	3807,	.6761,	.5504,
1973,	1460,	7678,	6465,	3227,	.4992,	.6002,
1974,	436,	6823,	5369,	2329,	.4338,	.4092,
1975,	3258,	7425,	5461,	3209,	.5877,	.8000,
1976,	1016,	6954,	3661,	3872,	1.0575,	.5815,
1977,	1459,	7616,	5874,	2458,	.4185,	.3995,
1978,	1421,	8246,	6007,	2931,	.4879,	.4066,
1979,	3458,	9502,	6558,	3737,	.5698,	.5525,
1980,	6248,	12055,	5862,	5821,	.9929,	.7870,
1981,	2619,	14065,	6018,	8516,	1.4150,	.8875,
1982,	1058,	13157,	9705,	7045,	.7259,	.6909,
1983,	3770,	13039,	9859,	7748,	.7859,	.9023,
1984,	3687,	10897,	4988,	5329,	1.0684,	.5479,
1985,	3166,	15203,	8831,	6683,	.7568,	.5689,
1986,	2652,	14915,	9784,	8418,	.8604,	.8261,
1987,	13288,	18255,	8177,	8220,	1.0052,	.8579,
1988,	6010,	25819,	8199,	13619,	1.6611,	.6910,
1989,	2074,	26451,	19122,	16674,	.8720,	.9145,
1990,	2331,	17636,	13799,	10093,	.7314,	1.0042,
1991,	5566,	12401,	7232,	6883,	.9518,	1.0087,
1992,	5812,	13544,	5312,	7605,	1.4316,	.8924,
1993,	1270,	14942,	8474,	8971,	1.0586,	.9178,
1994,	(10443),	17829,	10709,	8520,	.7956,	.9402,
Arith. Mean	3571,	13010,	7855,	6682,	.8529,	.7238,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

(): age 1 replaced by GM

Table 4.1.12

Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

Single option prediction: Input data

Year: 1995								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	2491.000	0.2000	0.0000	0.0000	0.0000	0.517	0.1470	0.919
2	1856.000	0.2000	0.0500	0.0000	0.0000	1.530	0.8755	2.042
3	268.000	0.2000	1.0000	0.0000	0.0000	4.420	1.1347	4.745
4	420.000	0.2000	1.0000	0.0000	0.0000	7.248	0.8622	7.467
5	121.000	0.2000	1.0000	0.0000	0.0000	10.393	0.8884	9.702
6	19.000	0.2000	1.0000	0.0000	0.0000	11.693	1.0288	11.737
7+	11.000	0.2000	1.0000	0.0000	0.0000	13.902	1.0288	13.772
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1996								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	2491.000	0.2000	0.0000	0.0000	0.0000	0.517	0.1470	0.919
2	.	0.2000	0.0500	0.0000	0.0000	1.530	0.8755	2.042
3	.	0.2000	1.0000	0.0000	0.0000	4.420	1.1347	4.745
4	.	0.2000	1.0000	0.0000	0.0000	7.248	0.8622	7.467
5	.	0.2000	1.0000	0.0000	0.0000	10.393	0.8884	9.702
6	.	0.2000	1.0000	0.0000	0.0000	11.693	1.0288	11.737
7+	.	0.2000	1.0000	0.0000	0.0000	13.902	1.0288	13.772
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	2491.000	0.2000	0.0000	0.0000	0.0000	0.517	0.1470	0.919
2	.	0.2000	0.0500	0.0000	0.0000	1.530	0.8755	2.042
3	.	0.2000	1.0000	0.0000	0.0000	4.420	1.1347	4.745
4	.	0.2000	1.0000	0.0000	0.0000	7.248	0.8622	7.467
5	.	0.2000	1.0000	0.0000	0.0000	10.393	0.8884	9.702
6	.	0.2000	1.0000	0.0000	0.0000	11.693	1.0288	11.737
7+	.	0.2000	1.0000	0.0000	0.0000	13.902	1.0288	13.772
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : SINGOP4
Date and time: 09SEP95:16:38

Table 4.1.13

Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

Yield per recruit: Summary table

						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	5.517	40781.100	3.739	39074.075	3.739	39074.075
0.1000	0.0940	0.277	2032.865	4.139	23775.859	2.372	22086.199	2.372	22086.199
0.2000	0.1880	0.416	2593.873	3.448	15931.222	1.693	14258.675	1.693	14258.675
0.3000	0.2821	0.501	2704.075	3.031	11586.238	1.287	9930.552	1.287	9930.552
0.4000	0.3761	0.558	2657.122	2.752	8912.070	1.018	7273.001	1.018	7273.001
0.5000	0.4701	0.599	2556.459	2.551	7147.053	0.828	5524.357	0.828	5524.357
0.6000	0.5641	0.631	2442.124	2.400	5921.628	0.687	4315.067	0.687	4315.067
0.7000	0.6581	0.656	2330.008	2.282	5037.065	0.580	3446.404	0.580	3446.404
0.8000	0.7522	0.676	2226.086	2.187	4378.253	0.495	2803.259	0.495	2803.259
0.9000	0.8462	0.692	2132.123	2.109	3874.651	0.428	2315.096	0.428	2315.096
1.0000	0.9402	0.706	2048.095	2.044	3481.070	0.372	1936.729	0.372	1936.729
1.1000	1.0342	0.718	1973.267	1.988	3167.503	0.327	1638.153	0.327	1638.153
1.2000	1.1282	0.729	1906.672	1.941	2913.419	0.288	1398.841	0.288	1398.841
1.3000	1.2223	0.738	1847.326	1.899	2704.413	0.256	1204.393	0.256	1204.393
1.4000	1.3163	0.746	1794.312	1.862	2530.155	0.229	1044.479	0.229	1044.479
1.5000	1.4103	0.753	1746.813	1.829	2383.095	0.205	911.555	0.205	911.555
1.6000	1.5043	0.760	1704.119	1.800	2257.620	0.185	800.009	0.185	800.009
1.7000	1.5983	0.766	1665.613	1.773	2149.492	0.167	705.607	0.167	705.607
1.8000	1.6924	0.771	1630.769	1.748	2055.468	0.151	625.109	0.151	625.109
1.9000	1.7864	0.777	1599.132	1.726	1973.035	0.138	556.003	0.138	556.003
2.0000	1.8804	0.781	1570.314	1.705	1900.218	0.126	496.321	0.126	496.321
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YR4
Date and time : 09SEP95:16:51
Computation of ref. F: Simple mean, age 2 - 5
F-0.1 factor : 0.1762
F-max factor : 0.3038
F-0.1 reference F : 0.1657
F-max reference F : 0.2857
Recruitment : Single recruit

Table 4.1.14

Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

Single option prediction: Detailed tables

Year: 1995 F-factor: 1.0000 Reference F: 0.9402

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.1470	309	284	2491	1288	0	0	0	0
2	0.8755	995	2033	1856	2840	93	142	93	142
3	1.1347	168	797	268	1185	268	1185	268	1185
4	0.8622	223	1666	420	3044	420	3044	420	3044
5	0.8884	66	636	121	1258	121	1258	121	1258
6	1.0288	11	132	19	222	19	222	19	222
7+	1.0288	7	90	11	153	11	153	11	153
Total		1779	5637	5186	9989	932	6003	932	6003
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1996 F-factor: 1.0000 Reference F: 0.9402

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.1470	309	284	2491	1288	0	0	0	0
2	0.8755	944	1928	1761	2694	88	135	88	135
3	1.1347	397	1882	633	2798	633	2798	633	2798
4	0.8622	37	280	71	511	71	511	71	511
5	0.8884	79	763	145	1509	145	1509	145	1509
6	1.0288	24	283	41	476	41	476	41	476
7+	1.0288	5	72	9	122	9	122	9	122
Total		1796	5492	5150	9399	986	5552	986	5552
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1997 F-factor: 1.0000 Reference F: 0.9402

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.1470	309	284	2491	1288	0	0	0	0
2	0.8755	944	1928	1761	2694	88	135	88	135
3	1.1347	376	1785	601	2655	601	2655	601	2655
4	0.8622	89	661	167	1208	167	1208	167	1208
5	0.8884	13	128	24	253	24	253	24	253
6	1.0288	29	340	49	572	49	572	49	572
7+	1.0288	9	118	14	201	14	201	14	201
Total		1769	5245	5107	8871	943	5024	943	5024
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : SINGOP4
Date and time : 09SEP95:16:38
Computation of ref. F: Simple mean, age 2 - 5
Prediction basis : F factors

Table 4.1.15

Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

Prediction with management option table

Year: 1995					Year: 1996					Year: 1997	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.9402	9989	6003	5637	0.0000	0.0000	9399	5552	0	17091	12839
.	.	.	.	.	0.1000	0.0940	.	5552	798	15885	11676
.	.	.	.	.	0.2000	0.1880	.	5552	1526	14788	10622
.	.	.	.	.	0.3000	0.2821	.	5552	2190	13789	9664
.	.	.	.	.	0.4000	0.3761	.	5552	2796	12878	8795
.	.	.	.	.	0.5000	0.4701	.	5552	3351	12049	8007
.	.	.	.	.	0.6000	0.5641	.	5552	3858	11292	7290
.	.	.	.	.	0.7000	0.6581	.	5552	4321	10602	6640
.	.	.	.	.	0.8000	0.7522	.	5552	4746	9972	6049
.	.	.	.	.	0.9000	0.8462	.	5552	5135	9397	5512
.	.	.	.	.	1.0000	0.9402	.	5552	5492	8871	5024
.	.	.	.	.	1.1000	1.0342	.	5552	5819	8390	4581
.	.	.	.	.	1.2000	1.1282	.	5552	6119	7951	4178
.	.	.	.	.	1.3000	1.2223	.	5552	6396	7548	3811
.	.	.	.	.	1.4000	1.3163	.	5552	6650	7179	3478
.	.	.	.	.	1.5000	1.4103	.	5552	6884	6841	3175
.	.	.	.	.	1.6000	1.5043	.	5552	7100	6531	2900
.	.	.	.	.	1.7000	1.5983	.	5552	7298	6246	2649
.	.	.	.	.	1.8000	1.6924	.	5552	7482	5984	2421
.	.	.	.	.	1.9000	1.7864	.	5552	7652	5744	2214
.	.	.	.	.	2.0000	1.8804	.	5552	7809	5522	2025
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : PRED4
Date and time : 09SEP95:16:48
Computation of ref. F: Simple mean, age 2 - 5
Basis for 1995 : F factors

Table 4.1.16 : Celtic Sea Cod. Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class	1991	1992	1993	1994	1995
Stock No. (thousands) of one-year-olds	5812	1270	2491	2491	2491
Source	VPA	VPA	GM	GM	GM
Status Quo F:					
% in 1995 catch	29.5	14.1	36.1	5.0	-
% in 1996 catch	13.9	5.1	34.3	35.1	5.2
% in 1995 SSB	50.7	19.7	2.4	0.0	-
% in 1996 SSB	27.2	9.2	50.4	2.4	0.0
% in 1997 SSB	11.4	5.0	24.0	52.8	2.7

GM = geometric mean recruitment

Celtic Sea Cod : Year-class % contribution to a) 1996 landings and b) 1997 SSB

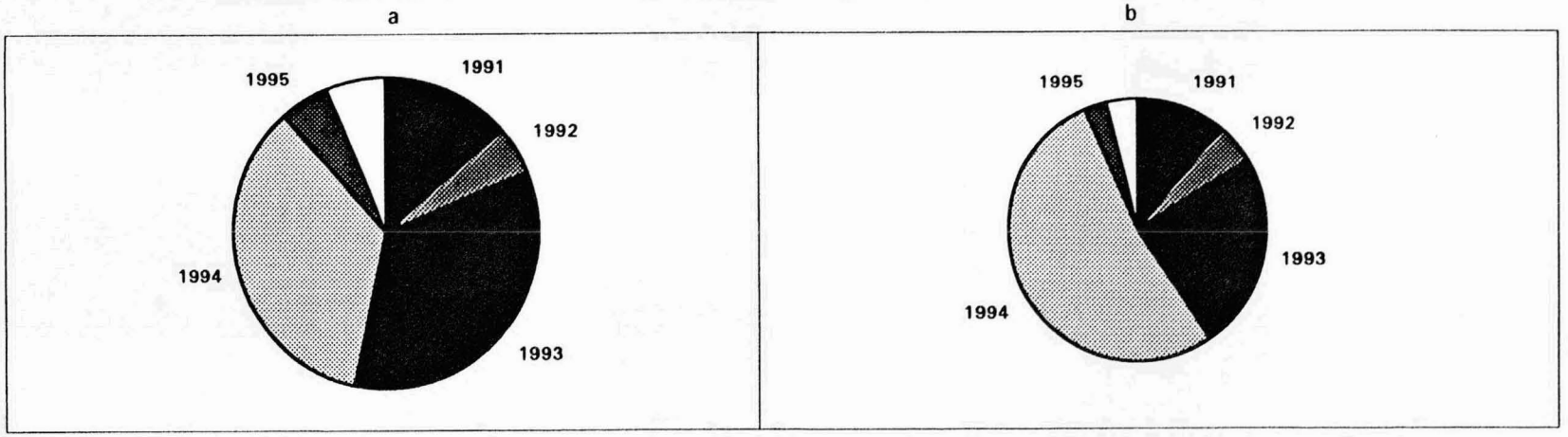


Figure 4.1.1 Celtic Sea Cod LOG CATCHABILITY RESIDUAL PLOTS (XSA)

ZEQ1LO = quarter 1 of French Lorient Gadoids trawlers with raw effort

ZEQ2LO = quarter 2 of French Lorient Gadoids trawlers with raw effort

ZEQ3LO = quarter 3 of French Lorient Gadoids trawlers with raw effort

ZEQ4LO = quarter 4 of French Lorient Gadoids trawlers with raw effort

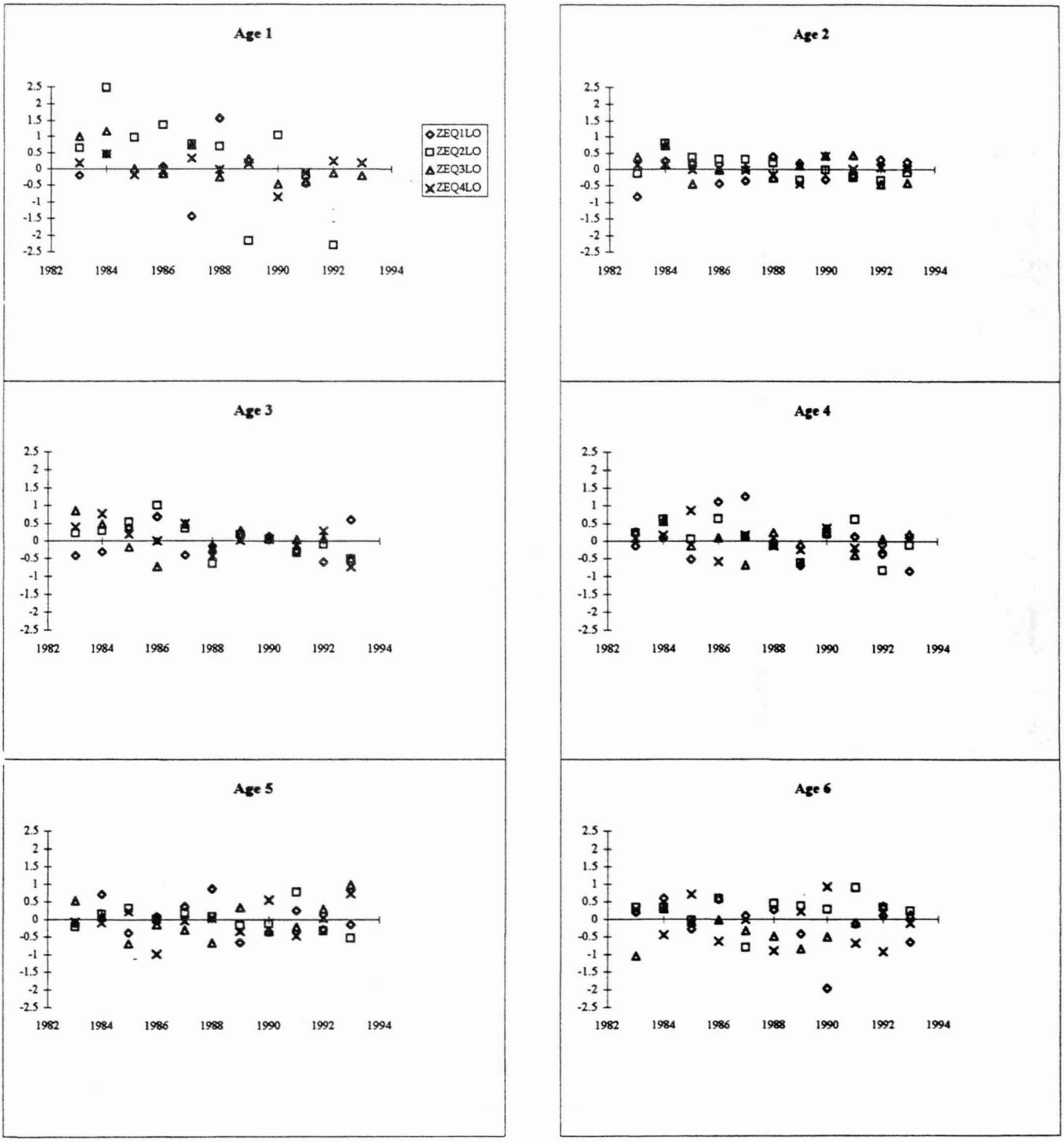
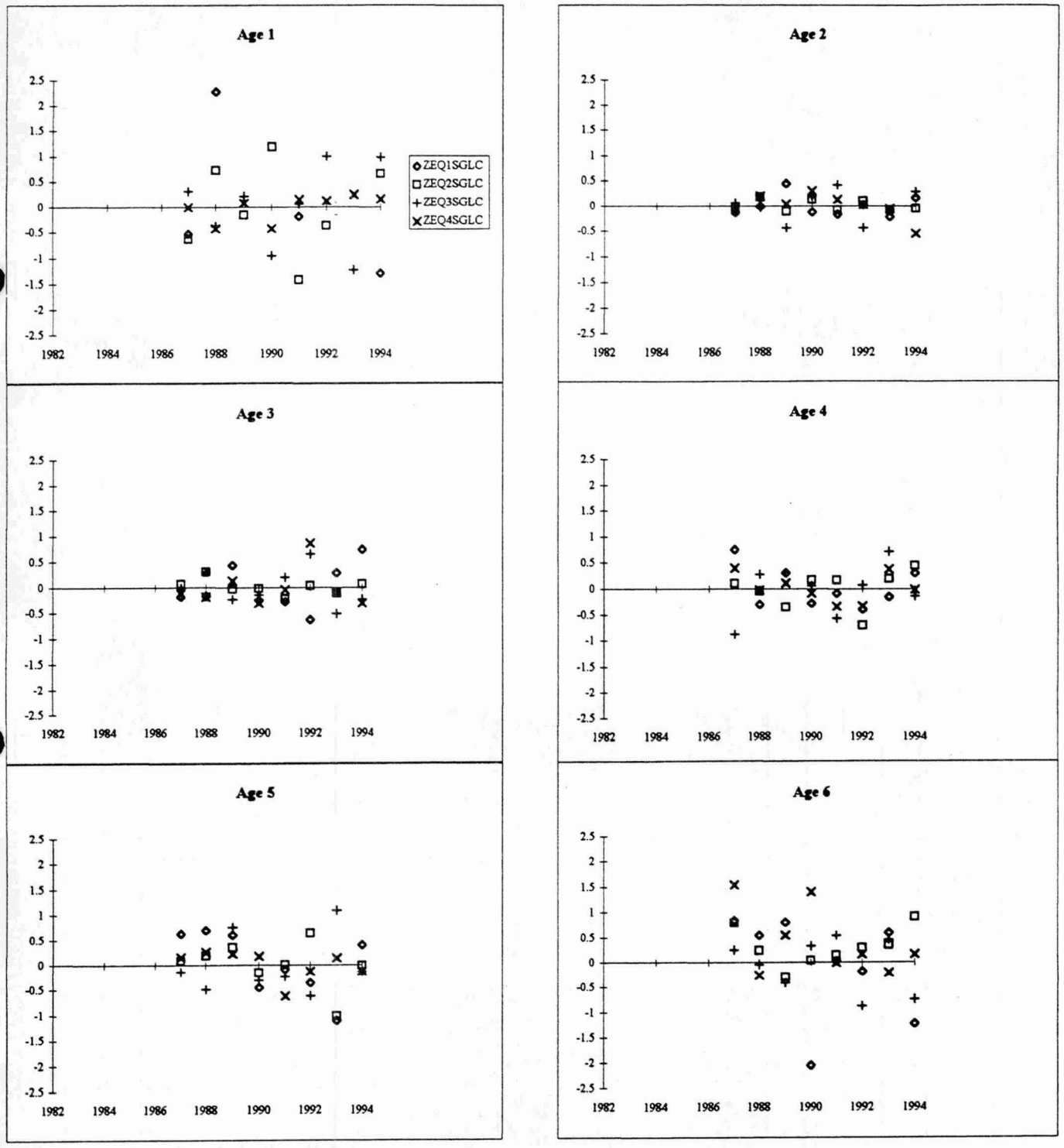


Figure 4.1.1 continued **Celtic Sea Cod** **LOG CATCHABILITY RESIDUAL PLOTS (XSA)**

ZEQ1SGLC = quarter 1 of Nephrops trawlers from St Guenole + Loctudy with raw effort
ZEQ2SGLC = quarter 2 of Nephrops trawlers from St Guenole + Loctudy with raw effort
ZEQ3SGLC = quarter 3 of Nephrops trawlers from St Guenole + Loctudy with raw effort
ZEQ4SGLC = quarter 4 of Nephrops trawlers from St Guenole + Loctudy with raw effort

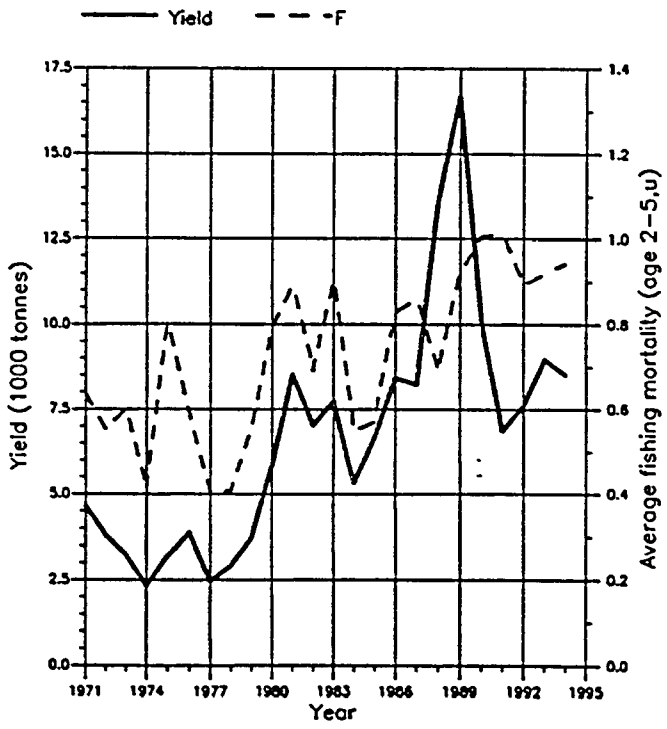


FISH STOCK SUMMARY

Figure 4.1.2 **STOCK: Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)**

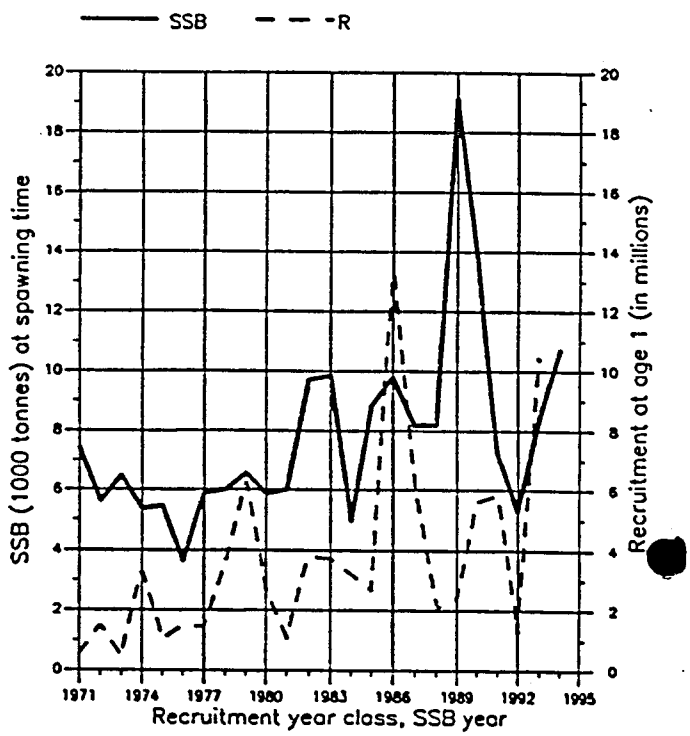
8–9–1995

Trends in yield and fishing mortality (F)



(run: VPAFIN2) **A**

Trends in spawning stock biomass (SSB) and recruitment (R)



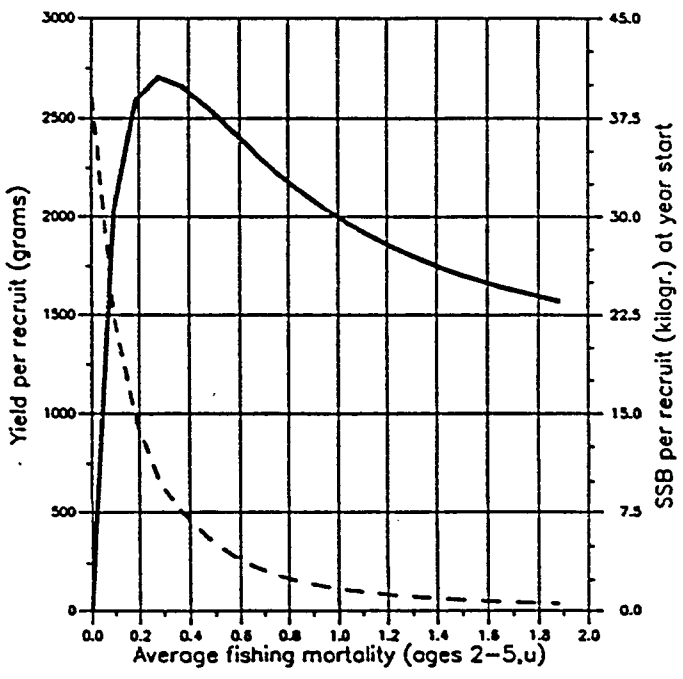
(run: VPAFIN2) **B**

FISH STOCK SUMMARY

STOCK: Cod in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

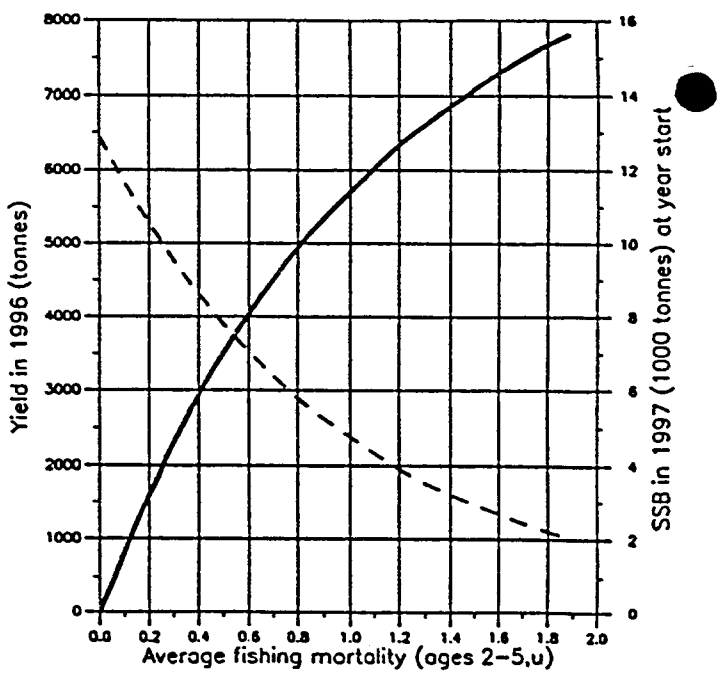
9–9–1995

Long term yield and spawning stock biomass



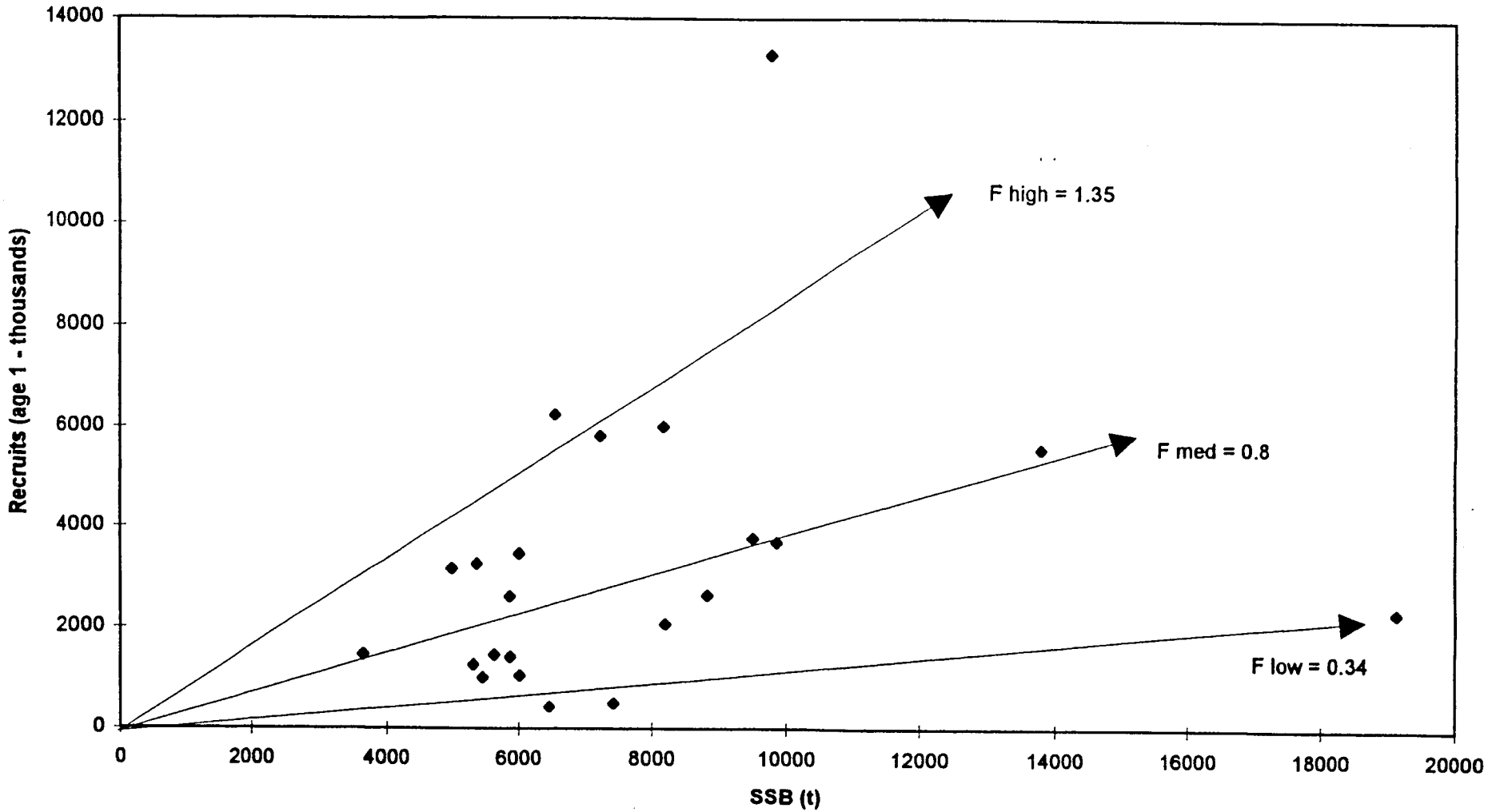
(run: YR4) **C**

Short-term yield and spawning stock biomass



(run: PRED4) **D**

Figure 4.1.3 :Celtic Sea Cod stock-recruitment



4.2 Celtic Sea Whiting (Divisions VIIf, VIIg and VIIh)

As last year, the assessment of Celtic Sea whiting includes data for Division VIIh. There are no estimates of discards for this stock. The French and international data since 1983 have been revised.

As mentioned in section 1.4, the 1994 catches and effort data by Division were not available for part of the Brittany fleet which usually takes a large part of the catches of cod and whiting in the Celtic Sea. Estimates of the missing data were obtained with the same procedures as for Celtic Sea cod (section 4.1). Missing data that had to be estimated represented 43 % of the international landings.

4.2.1 Landings, effort and CPUE trends

The international landings in VIIf,g,h for the period 1982 to 1994 averaged 9,600 t (Table 4.2.1). In 1989, there was an increase to 12,800 t due to the very good 1986 and 1987 year classes. Landings have been decreased in 1991 and 1992 then increased to an estimate of 13, 600 t in 1994, due to the good 1990 and 1991 year classes. France landed 82 %, Ireland 14 %, England and Wales 2 %, and Belgium 2 % of the 1994 landings. Between 1993 and 1994, only the landings of UK(E+W) vessels decreased. The *status quo* landings assumed for 1994 in last year's predictions were 18 % below the estimated landings.

As in previous year, no individual TACs were set for Divisions VIIf,g,h and a precautionary TAC covered all of Sub-area VII excluding VIIa (22,000 t in 1994 and 25,000 t in 1995).

Revised landings per unit effort data were available for the French Lorient gadoid trawlers up to 1993, and up to 1994 for the *Nephrops* trawlers from St Guenole and Loctudy, which take gadoids as by-catch. These series used raw effort (Table 4.2.2). Fishing effort of the St Guenole and Loctudy trawlers reached a maximum in 1992-1993 but slightly decreased in 1994, whereas LPUE increased.

4.2.2 Length and age compositions and weight at age

For 1994, France provided quarterly length compositions for the St Guenole and Loctudy trawlers and estimates of the quarterly length compositions for the Lorient fleet. UK provided quarterly length compositions. Ireland provided quarterly age compositions and weights at age. Belgium provided quarterly landings. The available length compositions by country were raised to the international landings in each quarter. The annual length compositions of the 1994 landings by France, UK and all countries together are shown in Table 4.2.3.

The 1994 age compositions were derived as in previous years, *i.e.* French ALKs were applied to the UK(E+W) length compositions and the combined French, Irish and English quarterly age compositions were raised to account for landings by Belgium. The same procedure was used for the revision of the data base for the years 1983 to 1993. The time series of landings at age for Divisions VIIf,g,h is given in Table 4.2.4.

Mean weights at age in the catch were derived by combining French, Irish and English data weighted by numbers landed at age. The SOP check was 100 % (Table 4.2.5). Weights at age in the stock for each year were taken as mean weights at age in the catch, weighted by numbers landed, during the first quarter except for age 1 which appears later in the year (Table 4.2.6).

Last year, ACFM again noted that mean weights at age in this stock are much larger than in other whiting stocks in adjacent areas, but it is known that whiting grows faster in this area. However the length-weight relationship used to process the French data (W g = 0.00278* L cm**3.358) is that provided by the former Irish Sea and Celtic Sea Working Group, but its appropriateness has not been validated for this fishery. From 1982 to 1993, the samples measured in France were not weighed, and the weight was estimated on the basis of this relationship. For the 1994 data, a new length-weight relationship (W g = 0.00316* L **3.268, L cm= middle of size class) estimated with data collected during the 1994 EVHOE Survey in ICES rectangle 31E2 was used. An examination of the 1993 French data showed that the weights at age estimated with this new relationship were 16 to 21 % lower, depending on the age, than with the old relationship.

As last year, the maturity ogive was assumed knife-edge at age 2 and SSB's were calculated at 1st January.

4.2.3 Estimation of fishing mortalities

The age range used in this assessment was 1-7+. Mean F was estimated between age 2 and 5.

A preliminary inspection of the quality of international catch at age data was carried out using Separable VPA with input parameters consistent with results of trial runs: reference age of 5, terminal F=1.75 and terminal S=0.95. The matrix of residuals (see ICES stock files) continues to reveal an inconsistency between the data for age 4 in 1985 and age 5 in 1986 which was explained in the 1993 report.

As in previous years, annual catch and effort data were available for the French gadoid fleet from Lorient for the period 1982-1993 (effort data missing for 1994). This series was revised for Divisions VIIf,g,h. The

CPUE data for the French *Nephrops* trawlers from St Guenole and Loctudy fishing in Divisions VIIf,g,h were also available for the period 1987-1994. As for Celtic Sea cod, a quarterly break down of the French Lorient and *Nephrops* trawlers fleets was made for trial runs. Abundance indices at age from the March English Groundfish surveys in Divisions VIIf,g were also available for 1987-1994. Table 4.2.7 shows the CPUE data used for VPA tuning.

Plots of Log catchability residuals from unshrunk L/S tuning runs using individual fleets (available in ICES stock files) again showed a "year effect" (negative values at all ages) for the Lorient fleets in 1989, and 1988 to a lesser extent. A negative "year effect" was also apparent for the *Nephrops* fleets in 1990 and 1991. The quarterly commercial fleets and the UK survey data remain excessively noisy, they were therefore excluded from the tuning fleets. The revision of the tuning data has not appreciably improved the quality of the results.

Trial XSA runs (in ICES stock file) showed that a taper time of 15 years improves the retrospective pattern, and this option was chosen. As last year, age 1 was treated as recruits and catchability was assumed to be independent of age for ages older than 4. Results showed that the estimate of the 1993 year class is mostly driven by the *Nephrops* fleet (60% of the weight).

Further runs assuming catchability to be independent of age for ages older than 3,4,5 or 6 indicated that age 4 is appropriate as the age of 'plateau q'.

Retrospective analyses were carried out with different shrinkage weights. The pattern improves after 1990, but the systematic tendency to overestimate mean F is reduced with weak shrinkage. For trends in SSB, a medium shrinkage seemed better. Given these results, a value of 0.5 was used for shrinkage.

The final VPA run was based on the following options: XSA using the two commercial fleets ; tri-cubic down-weighting over 15 years ; age range 1-7+ ; age 1 treated as recruits ; catchability independent of ages for ages 4 and older ; shrinkage to the mean F using medium SE of 0.5. F shrinkage for the older ages only uses a range of 3 previous ages in order to avoid including partially recruited ages.

Tuning diagnostics (Table 4.2.8) indicate that the Log-catchability residuals (Figure 4.2.2) generally show no particular trend. There is a year effect for the Lorient fleet in 1989 and 1993 as already pointed out in last year's assessment. The revision of data has not improved the pattern, which remain unexplained.

The fleets have a larger weight than shrinkage in the final estimations of survivors at all ages, contributing 60 to 80 % of the estimates depending on age. For age 1, where 40% is given by shrinkage, only the Nephrops fleet contributes to the estimation, since there is no data in 1994 for the Lorient fleet.

4.2.4 VPA results

Fishing mortalities at age, stock numbers at age and summary results obtained in the final VPA are shown in Table 4.2.9, 4.2.10 and 4.2.11. Figures 4.2.3a and b gives the yearly evolution of landings, F2-5, recruitment and SSB. F has been consistently above 1.0 up to 1991, then decreased in 1993 and is currently at 0.92. Due to the strong 1986 and 1987 year classes, SSB has reached a record value of 27,900 t in 1989. It has subsequently decreased to 13,700 t in 1991, due to a high level of F and the weak year class of 1988, rising again above 26,000 t in 1993 and 1994 as a result of strong 1990-1992 year classes. Recruitment shows high variations from year to year, reaching high values above 65 millions 1 -group in 1987 and 1992 down to below 20 millions in 1982 and 1989. The 1993 year class is estimated to be low (17.8 millions).

4.2.5 Yield per recruit and catch forecast

Input data for the predictions are given in Table 4.2.12. The exploitation pattern is based on average fishing mortalities at age in 1992-1994 re-scaled to mean F at ages 2-5 in 1994. Mean weights at age in the catches and in the stock are straight averages for 1992-1994. The low XSA estimate of 1-groups in 1994 was mainly due to the Nephrops trawl fleet, and was similar to the mean of the shrinkage values. It was therefore accepted for the forecasts. Stock number at age 2 and older at the start of 1995 were taken from XSA estimates. Recruitments in 1995-1997 were assumed equal to the geometric mean for 1982-1992 (34 million fish).

Results of yield per recruit analysis (Table 4.2.13 and Figure 4.2.3c) indicate that fishing at Fmax (0.35) would imply a 60 % reduction of fishing mortality under the current exploitation pattern, realising small gains in yield of about 8 % under equilibrium conditions. The stock recruitment plot (Figure 4.2.4) indicates that current fishing mortality is 35% below F med (1.38) and suggests that recruitment may be reduced at low levels of SSB.

Assuming *status quo* F, catches are predicted to remain at 13,500 t in 1995 and to decrease to 10,000 t in 1996 and 9,600 t in 1997 as the good 199-92 year classes are fished out (Table 4.2.14). SSB is estimated to have decreased from 2700 t in 1994 to 22,500 t in 1995, and is predicted to decrease further to 18,000 t in 1996 and 17,400 t in 1997, near to the average of the series. Catches and SSBs predicted for various intensities of fishing mortalities in 1996 are given in management option Table 4.2.15 and Figure 4.2.3d.

Estimates of the relative contribution of recent year classes to the 1996 landings and 1997 SSB are shown in Table 4.2.16. As expected for an early maturing fish, the predicted SSBs are heavily dependent on the assumed value of recruitment for the incoming year-classes, and GM assumptions contribute 76 % to the SSB in 1997.

4.2.6 Comments on the assessment

A comparison of successive assessments indicates a tendency to over-estimate F in the terminal year. In particular, this assessment brings about a large revision of the F9. Part of this may be due to the revision of the data base and also the lack of 1994 catch and effort data for the main fleet. Likewise, the SSBs have been revised upwards from year to year, but the new retrospective analysis made this year does not show this.

The predictions depend heavily on assumed recruitments, but there are no 0-group surveys for this stock and little prospects that such surveys would be successful. The Cirolana survey data (ages 1-7) were excluded because of large standard errors. The usefulness of this survey may improve as more years with the extended area coverage are added.

This year, missing data that had to be estimated represented 43 % of the total landings used by the Working Group, and corresponded to the major component of the Celtic Sea whiting fishery. If non-reporting of catches by Division continues for these fleets in future, the ability to provide assessments will be seriously jeopardised.

4.2.7 Management considerations

Catches and SSB of Celtic Sea whiting fluctuate considerably, depending on the strength of year-classes. Fishing mortality is very high and, at such levels, the contribution of good year-classes to SSB is very transitory.

Management of this stock should be considered in connection with Celtic Sea Cod which is taken essentially in the same fishery. Combined forecasts are presented in Figure 4.2.5.

Table 4.2.1 Nominal catches landed of Celtic Sea Whiting as used by the Working Group in 1995.

Divisions VIIf, VIIg and VIIh

Year	Belgium	France	Ireland	UK (England and Wales)	Total
1982	70	7316	62	191	7639
1983	125	8282	124	165	8696
1984	157	6737	299	231	7424
1985	165	7095	138	192	7590
1986	105	6756	138	136	7135
1987	109	8422	198	289	9018
1988	155	9717	189	354	10415
1989	293	10900	1334	309	12836
1990	304	9750	174	412	10640
1991	290	9111	190	481	10072
1992	106	8452	236	305	9099
1993	143	9975	654	341	11113
1994*	225	11168	1909	330	13632

*= provisional

Table 4.2.2 Celtic Sea Whiting (VIIf,g,h). LPUE and effort of French fleets. Indices of international effort.

	Lorient gadoid trawlers VIIf,g,h		Nephrops trawlers of St Guenole+Loctudy VIIf,g,h		
Year	LPUE (1)	Effort (2)	LPUE (1)	Effort (2)	Total international index
1979	818.7	2,897			7,331
1980	974.1	3,284			8,644
1981	932.1	3,127			9,083
1982	834	3,101			8,982
1983	1,073.6	4,148			7,801
1984	1,118.3	3,749			6,486
1985	1,264.7	2,847			5,945
1986	1,103.4	3,103	102.9	4,998	6,179
1987	1,298.8	3,479	108.9	5,445	6,859
1988	1,462.4	3,225	149.5	5,580	7,232
1989	1,373.0	3,571	142.5	6,200	9,625
1990	1,142.3	3,559	93.9	6,701	8,521
1991	1,283.6	3,313	89.1	7,083	7,876
1992	1,251.6	3,047	112.8	7,922	7,158
1993	1,550.8	2,366	194.2	8,799	7,295
1994	n/a	n/a	232.3	8,139	n/a

CPUE (1) = Catch in Kg per 100 hours fishing, power corrected.
EFFort (2) = Hours fishing x 10-4, power corrected
Index = Effort Lor.Gad.trawl x international landings / landings of Lor.Gad.trawl.

Table 4.2.3 **Celtic Sea Whiting (VIIf,g,h). Annual length composition**

Nos in thousands

1994 Length	Lorient VIIfgh estimations	StGue+Ioct VIIfgh	France VIIfgh estimations	UK(E+W) VIIfgh	All VIIfgh estimations
20					
21					
22					
23				0	0
24				0	1
25				2	2
26				2	3
27	6	7	26	12	47
28	38	20	112	28	175
29	88	25	221	53	342
30	191	107	575	62	798
31	373	263	1217	72	1613
32	522	369	1709	58	2211
33	734	447	2286	53	2927
34	909	578	2885	51	3673
35	761	518	2487	51	3176
36	777	479	2470	44	3145
37	713	389	2186	34	2777
38	527	335	1694	37	2166
39	419	219	1262	41	1631
40	354	240	1156	31	1485
41	281	164	861	18	1099
42	194	131	619	25	805
43	159	81	455	20	594
44	131	82	397	20	522
45	96	53	278	13	364
46	94	30	231	10	302
47	66	29	174	11	232
48	72	21	172	7	224
49	60	15	138	7	181
50	49	13	114	6	151
51	60	14	134	2	171
52	38	11	90	5	118
53	35	6	75	5	100
54	32	4	65	2	84
55	23	1	44	2	58
56	16	2	33	1	44
57	7	1	14	1	19
58	5	3	15	0	20
59	3	0	5	1	8
60	5	1	10	1	14
61	1	0	2	0	2
62	3	1	7	0	9
63	1		2		3
64	1		2		2
65					0
total Numb	7845	4661	24226	791	31298
t ww	3686.7	2020	11168.4	330.4	13632

Table 4.2.4

Run title : Whiting, Celtic Sea (run: VPAFIN/ROB)

At 8-Sep-95 09:56:36

Table 1	Catch numbers at age	Numbers*10**-3	
YEAR,	1982,	1983,	1984,
AGE			
1,	1440,	3619,	1981,
2,	7080,	6110,	11221,
3,	5639,	5500,	2818,
4,	2588,	2023,	1091,
5,	497,	798,	348,
6,	22,	116,	74,
+gp,	12,	6,	13,
TOTALNUM,	17278,	18172,	17546,
TONSLAND,	7639,	8696,	7424,
SOPCOF %,	100,	102,	102,

Table 1	Catch numbers at age	Numbers*10**-3							
YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	2274,	2299,	3543,	1373,	400,	1774,	5258,	3099,	1392,	390,
2,	9059,	9099,	11400,	15204,	11081,	5774,	7425,	12664,	13224,	9161,
3,	4553,	3807,	5179,	6467,	15596,	12564,	3442,	5657,	8435,	16903,
4,	788,	1234,	1456,	1118,	2202,	5455,	7343,	869,	1276,	4300,
5,	168,	340,	347,	233,	220,	484,	1682,	797,	197,	694,
6,	57,	17,	66,	42,	43,	33,	86,	268,	203,	89,
+gp,	23,	8,	33,	13,	15,	13,	2,	23,	126,	151,
TOTALNUM,	16922,	16804,	22024,	24450,	29557,	26097,	25238,	23377,	24853,	31688,
TONSLAND,	7590,	7135,	9018,	10415,	12836,	10639,	10072,	9099,	11113,	13632,
SOPCOF %,	101,	99,	100,	100,	100,	100,	100,	100,	101,	100,

Table 4.2.5

Run title : Whiting, Celtic Sea (run: VPAFIN/ROB)

At 8-Sep-95 09:56:36

Table 2 Catch weights at age (kg)

YEAR,	1982,	1983,	1984,
AGE			
1,	.2810,	.3230,	.2740,
2,	.3320,	.3870,	.3460,
3,	.4770,	.5270,	.5520,
4,	.6750,	.6560,	.7910,
5,	.7950,	.8220,	.9920,
6,	1.5590,	.9040,	1.3210,
+gp,	1.9290,	1.9680,	1.8870,
SOPCOFAC,	.9993,	1.0193,	1.0154,

Table 2 Catch weights at age (kg)

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	.2710,	.2290,	.2680,	.2660,	.2360,	.2550,	.2630,	.2460,	.2460,	.2170,
2,	.3870,	.3320,	.3410,	.3640,	.3340,	.3080,	.3470,	.3440,	.3560,	.3040,
3,	.5400,	.6080,	.4820,	.5070,	.4530,	.3930,	.4240,	.4630,	.5090,	.4140,
4,	.7750,	.7470,	.8130,	.7700,	.7260,	.5450,	.4720,	.5630,	.7510,	.6550,
5,	1.2120,	1.1240,	1.0940,	1.2220,	1.2200,	.8860,	.6460,	.7450,	1.1050,	.9470,
6,	1.4470,	1.4290,	1.1210,	1.6560,	1.8210,	1.4610,	1.0670,	.9060,	1.3620,	.9350,
+gp,	1.1800,	1.6380,	1.5360,	1.7220,	2.5150,	2.0790,	1.2480,	1.2830,	1.6480,	1.3940,
SOPCOFAC,	1.0114,	.9905,	.9996,	.9999,	.9994,	.9994,	1.0006,	1.0006,	1.0099,	.9998,

Table 4.2.6

Run title : Whiting, Celtic Sea (run: VPAFIN/ROB)

At 8-Sep-95 09:56:36

Table 3 Stock weights at age (kg)			
YEAR,	1982,	1983,	1984,
AGE			
1,	.2810,	.2230,	.2740,
2,	.2900,	.3260,	.3300,
3,	.4560,	.4880,	.5110,
4,	.7250,	.6460,	.7570,
5,	.7290,	.8000,	.9780,
6,	1.5190,	1.2160,	1.4630,
+gp,	1.9170,	1.6140,	1.9650,

Table 3 Stock weights at age (kg)										
YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	.2710,	.2290,	.2630,	.2140,	.2330,	.1670,	.1870,	.1750,	.2450,	.1350,
2,	.3400,	.3380,	.2890,	.2950,	.3000,	.2690,	.3000,	.2940,	.2710,	.2240,
3,	.5910,	.6080,	.4540,	.4800,	.4210,	.3590,	.3960,	.4350,	.4730,	.3930,
4,	.7660,	.7470,	.8550,	.9160,	.7430,	.5510,	.4240,	.4500,	.7910,	.6320,
5,	1.0420,	1.1240,	1.1570,	1.2000,	1.1760,	.7660,	.5550,	.6630,	1.3520,	.9290,
6,	1.5170,	1.4290,	1.4810,	1.7700,	1.5590,	1.4150,	1.0610,	.6970,	1.2750,	.7350,
+gp,	1.5340,	1.6380,	1.4810,	1.8030,	2.4640,	2.1480,	1.1570,	1.4890,	1.8330,	1.3460,

Table 4.2.7

WHG-CELT: Whiting in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

FLT06: ZE French lorient gadoids trawlers (FE*10**-3)

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1982	310.843	472.5	2760.6	2217.6	1045.4	198.9	9.3	3.5
1983	414.811	1631.2	3294.8	3025.9	1166.0	469.6	66.4	3.4
1984	374.858	983.1	6549.9	1708.7	661.1	218.4	43.7	4.5
1985	284.659	914.1	4482.4	2157.1	394.3	89.4	31.1	14.1
1986	310.305	836.5	4484.4	1958.7	602.9	158.3	6.8	1.6
1987	347.885	1662.8	6092.5	2683.7	745.2	177.4	36.0	12.6
1988	322.539	575.6	6921.2	3004.9	475.4	103.8	16.9	4.9
1989	357.060	146.7	4085.0	5945.8	797.1	80.9	13.9	3.2
1990	355.937	687.0	2623.8	5418.5	2283.8	179.9	12.0	4.6
1991	331.343	2541.0	3222.9	1449.7	2991.5	655.8	33.6	0.3
1992	304.731	1366.8	5761.9	2427.3	368.8	307.6	105.0	10.1
1993	236.627	390.1	4557.5	2650.4	337.5	56.2	80.0	37.1

WHG-CELT: Whiting in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

FLT16: ZE Nephrops trawlers St Guenole + Loctudy (FE*10**-3)

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1987	544.483	180.4	489.0	309.1	124.3	30.8	6.3	2.1
1988	558.023	99.8	907.3	485.5	112.0	23.4	5.0	1.6
1989	619.970	19.4	603.8	892.8	170.9	22.4	5.3	0.3
1990	670.131	54.0	158.7	551.2	335.1	45.1	4.2	1.2
1991	708.254	231.8	340.2	165.3	366.7	110.2	7.4	0.5
1992	792.176	243.0	952.8	536.2	85.5	97.7	32.4	2.0
1993	879.886	197.0	1643.3	1454.2	245.6	34.4	28.4	17.2
1994	813.956	42.9	1351.9	2574.2	588.6	77.5	10.6	11.8

WHG-CELT: Whiting in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

FLT22: UK (E+W) PHHT GFS (N*10**3)

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1987	360	129	580	57	8	6	4	1
1988	540	129	125	31	3	3	0	0
1989	540	137	393	267	21	4	2	0
1990	540	11	31	137	55	9	1	0
1991	482	99	6	3	11	9	1	0
1992	840	1097	441	94	28	22	6	1
1993	840	4101	722	229	29	4	8	3
1994	535	4809	713	490	70	17	1	3

Table 4.2.8

Extended Survivors Analysis

Whiting, Celtic Sea (run: VPAFIN/ROB)

CPUE data from file /users/fish/ifad/ifapwork/wgssds/whg_celt/FLEET.ROB

Catch data for 13 years. 1982 to 1994. Ages 1 to 7.

Fleet,	First, year,	Last, year,	First, age,	Last, age	Alpha,	Beta
FLT06: ZE French lor,	1982,	1994,	1,	6,	.000,	1.000
FLT16: ZE Nephrops t,	1987,	1994,	1,	6,	.000,	1.000

Time series weights :

Tapered time weighting applied
Power = 3 over 15 years

Catchability analysis :

Catchability dependent on stock size for ages < 2

Regression type = C
Minimum of 5 points used for regression
Survivor estimates shrunk to the population mean for ages < 2

Catchability independent of age for ages >= 4

Terminal population estimation :

Survivor estimates shrunk towards the mean F
of the final 5 years or the 3 oldest ages.

S.E. of the mean to which the estimates are shrunk = .500

Minimum standard error for population
estimates derived from each fleet = .300

Prior weighting not applied

Tuning converged after 21 iterations

Log catchability residuals.

Fleet : FLT06: ZE French lor

Age	1982	1983	1984
1	.42	.68	.53
2	.04	.31	.62
3	-.04	.36	.18
4	-.04	.28	.53
5	.07	.56	.44
6	.01	.35	.28

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	.63	.20	.03	-.63	-.68	.20	.75	-.06	-.57	99.99
2	.66	.47	.34	-.24	-.75	.16	-.03	.03	-.43	99.99
3	.33	.19	.39	.08	-.30	-.37	.07	.10	-.33	99.99
4	-.03	.17	.36	.17	-.16	-.20	.30	-.05	-.65	99.99
5	.78	.27	.44	.19	-.02	-.03	.09	-.17	-.49	99.99
6	.36	-.03	.24	-.14	-.38	-.34	.04	-.09	-.05	99.99

Table 4.2.8 (cont'd.)

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age ,	2,	3,	4,	5,	6
Mean Log q,	-7.2491,	-6.6186,	-6.4499,	-6.4499,	-6.4499,
S.E(Log q),	.4329,	.2810,	.3397,	.3586,	.2441,

Regression statistics :

Ages with q dependent on year class strength

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Log q
1,	.85,	.346,	9.70,	.46,	12,	.58,	-9.54,

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
2,	2.45,	-2.549,	2.93,	.34,	12,	.80,	-7.25,
3,	1.63,	-4.106,	4.91,	.87,	12,	.26,	-6.62,
4,	1.03,	-.176,	6.40,	.82,	12,	.38,	-6.45,
5,	1.09,	-.467,	6.36,	.80,	12,	.40,	-6.37,
6,	.95,	.450,	6.41,	.94,	12,	.24,	-6.49,

Fleet : FLT16: ZE Nephrops t

Age ,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994
1 ,	99.99,	99.99,	-.01,	-.23,	-.16,	.01,	.29,	-.09,	.05,	.10
2 ,	99.99,	99.99,	.24,	.05,	-.33,	-.40,	-.16,	.15,	.12,	.33
3 ,	99.99,	99.99,	.30,	.23,	-.23,	-.77,	-.34,	.15,	.28,	.42
4 ,	99.99,	99.99,	.41,	.46,	.04,	-.46,	-.27,	-.17,	.01,	.15
5 ,	99.99,	99.99,	.53,	.44,	.44,	.24,	-.17,	.02,	.00,	.13
6 ,	99.99,	99.99,	.34,	.38,	.40,	.27,	.06,	.07,	-.11,	.07

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age ,	2,	3,	4,	5,	6
Mean Log q,	-10.1281,	-9.1360,	-8.7399,	-8.7399,	-8.7399,
S.E(Log q),	.2701,	.4178,	.3142,	.3154,	.2639,

Regression statistics :

Ages with q dependent on year class strength

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Log q
1,	.65,	2.860,	11.73,	.93,	8,	.18,	-12.37,

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
2,	.78,	1.374,	10.18,	.88,	8,	.20,	-10.13,
3,	1.04,	-.129,	9.12,	.70,	8,	.47,	-9.14,
4,	1.29,	-1.590,	8.90,	.85,	8,	.36,	-8.74,
5,	1.33,	-2.650,	9.22,	.92,	8,	.23,	-8.56,
6,	1.24,	-3.295,	9.45,	.97,	8,	.15,	-8.57,

Table 4.2.8 (cont'd.)

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT06: ZE French lor,	1.,	.000,	.000,	.00,	0, .000,	.000
FLT16: ZE Nephrops t,	15734.,	.300,	.000,	.00,	1, .577,	.022
P shrinkage mean ,	28744.,	.50,,,,			.211,	.012
F shrinkage mean ,	5441.,	.50,,,,			.213,	.063

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
14250.,	.23,	.40,	3,	1.737,	.024

Age 2 Catchability constant w.r.t. time and dependent on age

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT06: ZE French lor,	13034.,	.627,	.000,	.00,	1, .083,	.492
FLT16: ZE Nephrops t,	27765.,	.212,	.141,	.67,	2, .734,	.261
F shrinkage mean ,	13752.,	.50,,,,			.183,	.472

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
22934.,	.19,	.21,	4,	1.103,	.309

Age 3 Catchability constant w.r.t. time and dependent on age

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT06: ZE French lor,	7792.,	.373,	.172,	.46,	2, .144,	1.086
FLT16: ZE Nephrops t,	11867.,	.194,	.140,	.72,	3, .581,	.828
F shrinkage mean ,	9710.,	.50,,,,			.275,	.946

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
10570.,	.19,	.10,	6,	.546,	.895

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT06: ZE French lor,	1558.,	.243,	.210,	.86,	3, .196,	1.252
FLT16: ZE Nephrops t,	2256.,	.197,	.036,	.18,	4, .470,	1.002
F shrinkage mean ,	1585.,	.50,,,,			.334,	1.240

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1865.,	.20,	.09,	8,	.462,	1.127

Table 4.2.8 (cont'd.)

Age 5 Catchability constant w.r.t. time and age (fixed at the value for age) 4

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: ZE French lor,	153.,	.236,	.209,	.88,	4,	.163,	1.628
FLT16: ZE Nephrops t,	235.,	.211,	.041,	.19,	5,	.423,	1.302
F shrinkage mean ,	233.,	.50,,,,				.414,	1.306

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
218.,	.23,	.07,	10,	.327,	1.355

Age 6 Catchability constant w.r.t. time and age (fixed at the value for age) 4

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT06: ZE French lor,	25.,	.257,	.119,	.46,	5,	.137,	1.428
FLT16: ZE Nephrops t,	35.,	.212,	.043,	.20,	6,	.485,	1.185
F shrinkage mean ,	38.,	.50,,,,				.378,	1.139

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
35.,	.22,	.05,	12,	.246,	1.199

Table 4.2.9

Run title : Whiting, Celtic Sea (run: VPAFIN/ROB)

At 8-Sep-95 09:56:36

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1982,	1983,	1984,
AGE			
1,	.0972,	.1422,	.0941,
2,	.5951,	.7531,	.8642,
3,	1.0285,	1.4770,	1.0024,
4,	1.1954,	1.5483,	1.7086,
5,	1.3479,	2.0249,	1.5055,
6,	1.2042,	1.6728,	1.3655,
+gp,	1.2042,	1.6728,	1.3655,
FBAR 2- 5,	1.0417,	1.4508,	1.2702,

Table 8 Fishing mortality (F) at age YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	FBAR 92-94
AGE											
1,	.1005,	.0764,	.0607,	.0280,	.0271,	.0778,	.1245,	.0514,	.0325,	.0245,	.0361,
2,	.8007,	.7276,	.6552,	.3977,	.3284,	.6627,	.5341,	.4946,	.3212,	.3085,	.3748,
3,	1.1408,	.9939,	1.3623,	1.0252,	.9467,	.7730,	1.1532,	1.0699,	.7351,	.8949,	.9000,
4,	.8893,	1.2204,	1.5846,	1.4525,	1.3606,	1.1203,	1.7866,	1.1045,	.7499,	1.1270,	.9938,
5,	1.8994,	1.4082,	1.7170,	1.4181,	1.5459,	1.5056,	1.5052,	1.0751,	.8180,	1.3546,	1.0826,
6,	1.2090,	1.2116,	1.3178,	1.1247,	1.2221,	1.1285,	1.4317,	1.1461,	.9176,	1.1993,	1.0877,
+gp,	1.2090,	1.2116,	1.3178,	1.1247,	1.2221,	1.1285,	1.4317,	1.1461,	.9176,	1.1993,	
FBAR 2- 5,	1.1826,	1.0875,	1.3298,	1.0734,	1.0454,	1.0154,	1.2448,	.9360,	.6561,	.9212,	

Table 4.2.10

Run title : Whiting, Celtic Sea (run: VPAFIN/R08)

At 8-Sep-95 09:56:36

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR,	1982,	1983,	1984,
AGE			
1,	17179,	30178,	24383,
2,	17445,	12762,	21433,
3,	9700,	7877,	4920,
4,	4101,	2839,	1472,
5,	742,	1016,	494,
6,	35,	158,	110,
+gp,	19,	8,	19,
TOTAL,	49221,	54839,	52831,

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	GMST 82-92	AMST 82-92
AGE													
1,	26273,	34556,	66455,	54953,	16528,	26180,	49622,	68403,	48118,	17836,	0,	33597,	37701,
2,	18170,	19453,	26212,	51203,	43749,	13170,	19829,	35870,	53200,	38136,	14250,	22944,	25391,
3,	7395,	6680,	7694,	11145,	28164,	25792,	5558,	9517,	17909,	31591,	22934,	9563,	11313,
4,	1478,	1935,	2024,	1613,	3273,	8947,	9748,	1436,	2673,	7030,	10570,	2741,	3533,
5,	218,	497,	467,	340,	309,	687,	2389,	1337,	390,	1034,	1865,	610,	773,
6,	90,	27,	100,	69,	67,	54,	125,	434,	374,	141,	218,	86,	115,
+gp,	35,	12,	49,	21,	23,	21,	3,	37,	228,	234,	92,		
TOTAL,	53661,	63160,	103000,	119343,	92114,	74852,	87275,	117033,	122890,	96001,	49929,		

Table 4.2.11

Run title : Whiting, Celtic Sea (run: VPAFIN/ROB)

At 8-Sep-95 09:56:36

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 2- 5,
1982,	17179,	17912,	13085,	7639,	.5838,	1.0417,
1983,	30178,	17586,	10856,	8696,	.8010,	1.4508,
1984,	24383,	18064,	11383,	7424,	.6522,	1.2702,
1985,	26273,	19219,	12099,	7590,	.6273,	1.1826,
1986,	34556,	20612,	12699,	7135,	.5618,	1.0875,
1987,	66455,	31037,	13559,	9018,	.6651,	1.3298,
1988,	54953,	34259,	22499,	10415,	.4629,	1.0734,
1989,	16528,	31790,	27939,	12836,	.4594,	1.0454,
1990,	26180,	22752,	18380,	10639,	.5789,	1.0154,
1991,	49622,	23024,	13745,	10072,	.7328,	1.2448,
1992,	68403,	28546,	16575,	9099,	.5490,	.9360,
1993,	48118,	38212,	26423,	11113,	.4206,	.6561,
1994,	17836,	29187,	26779,	13632,	.5091,	.9212,
Arith. Mean	36974,	25554,	17386,	9639,	.5849,	1.0965,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

Table 4.2.12

Whiting in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

Single option prediction: Input data

Year: 1995								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	33597.000	0.2000	0.0000	0.0000	0.0000	0.185	0.0397	0.236
2	14250.000	0.2000	1.0000	0.0000	0.0000	0.263	0.4121	0.335
3	22934.000	0.2000	1.0000	0.0000	0.0000	0.434	0.9896	0.462
4	10570.000	0.2000	1.0000	0.0000	0.0000	0.624	1.0927	0.656
5	1865.000	0.2000	1.0000	0.0000	0.0000	0.981	1.1904	0.932
6	218.000	0.2000	1.0000	0.0000	0.0000	0.902	1.1960	1.068
7+	92.000	0.2000	1.0000	0.0000	0.0000	1.556	1.1960	1.442
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1996								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	33597.000	0.2000	0.0000	0.0000	0.0000	0.185	0.0397	0.236
2	.	0.2000	1.0000	0.0000	0.0000	0.263	0.4121	0.335
3	.	0.2000	1.0000	0.0000	0.0000	0.434	0.9896	0.462
4	.	0.2000	1.0000	0.0000	0.0000	0.624	1.0927	0.656
5	.	0.2000	1.0000	0.0000	0.0000	0.981	1.1904	0.932
6	.	0.2000	1.0000	0.0000	0.0000	0.902	1.1960	1.068
7+	.	0.2000	1.0000	0.0000	0.0000	1.556	1.1960	1.442
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	33597.000	0.2000	0.0000	0.0000	0.0000	0.185	0.0397	0.236
2	.	0.2000	1.0000	0.0000	0.0000	0.263	0.4121	0.335
3	.	0.2000	1.0000	0.0000	0.0000	0.434	0.9896	0.462
4	.	0.2000	1.0000	0.0000	0.0000	0.624	1.0927	0.656
5	.	0.2000	1.0000	0.0000	0.0000	0.981	1.1904	0.932
6	.	0.2000	1.0000	0.0000	0.0000	0.902	1.1960	1.068
7+	.	0.2000	1.0000	0.0000	0.0000	1.556	1.1960	1.442
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : SINGOPT3
Date and time: 10SEP95:08:24

Table 4.2.13

Whiting in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

Yield per recruit: Summary table

						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	5.517	4392.176	4.517	4207.176	4.517	4207.176
0.1000	0.0921	0.263	225.664	4.207	2592.408	3.207	2407.408	3.207	2407.408
0.2000	0.1842	0.386	288.772	3.598	1837.121	2.598	1652.121	2.598	1652.121
0.3000	0.2764	0.459	306.607	3.242	1438.921	2.242	1253.921	2.242	1253.921
0.4000	0.3685	0.507	309.275	3.005	1199.852	2.005	1014.852	2.005	1014.852
0.5000	0.4606	0.542	306.643	2.835	1043.248	1.835	858.248	1.835	858.248
0.6000	0.5527	0.569	302.339	2.706	933.899	1.706	748.899	1.706	748.899
0.7000	0.6448	0.590	297.758	2.603	853.703	1.603	668.703	1.603	668.703
0.8000	0.7370	0.608	293.421	2.520	792.551	1.520	607.551	1.520	607.551
0.9000	0.8291	0.622	289.502	2.450	744.429	1.450	559.429	1.450	559.429
1.0000	0.9212	0.635	286.027	2.391	705.569	1.391	520.569	1.391	520.569
1.1000	1.0133	0.646	282.969	2.339	673.508	1.339	488.508	1.339	488.508
1.2000	1.1054	0.655	280.282	2.294	646.572	1.294	461.572	1.294	461.572
1.3000	1.1976	0.664	277.916	2.255	623.593	1.255	438.593	1.255	438.593
1.4000	1.2897	0.672	275.826	2.219	603.727	1.219	418.727	1.219	418.727
1.5000	1.3818	0.679	273.971	2.187	586.355	1.187	401.355	1.187	401.355
1.6000	1.4739	0.685	272.318	2.157	571.010	1.157	386.010	1.157	386.010
1.7000	1.5660	0.691	270.836	2.130	557.335	1.130	372.335	1.130	372.335
1.8000	1.6582	0.696	269.501	2.106	545.052	1.106	360.052	1.106	360.052
1.9000	1.7503	0.702	268.293	2.083	533.942	1.083	348.942	1.083	348.942
2.0000	1.8424	0.706	267.194	2.062	523.829	1.062	338.829	1.062	338.829
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YR4
Date and time : 10SEP95:08:32
Computation of ref. F: Simple mean, age 2 - 5
F-0.1 factor : 0.1782
F-max factor : 0.3831
F-0.1 reference F : 0.1642
F-max reference F : 0.3530
Recruitment : Single recruit

Table 4.2.14

Whiting in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

Single option prediction: Detailed tables

Year: 1995 F-factor: 1.0000 Reference F: 0.9212

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0397	1186	280	33597	6215	0	0	0	0
2	0.4121	4392	1470	14250	3748	14250	3748	14250	3748
3	0.9896	13272	6132	22934	9946	22934	9946	22934	9946
4	1.0927	6482	4254	10570	6599	10570	6599	10570	6599
5	1.1904	1199	1118	1865	1830	1865	1830	1865	1830
6	1.1960	141	150	218	197	218	197	218	197
7+	1.1960	59	86	92	143	92	143	92	143
Total		26731	13490	83526	28678	49929	22463	49929	22463
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1996 F-factor: 1.0000 Reference F: 0.9212

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0397	1186	280	33597	6215	0	0	0	0
2	0.4121	8148	2727	26436	6953	26436	6953	26436	6953
3	0.9896	4471	2066	7727	3351	7727	3351	7727	3351
4	1.0927	4280	2809	6980	4358	6980	4358	6980	4358
5	1.1904	1866	1740	2902	2848	2902	2848	2902	2848
6	1.1960	299	320	464	419	464	419	464	419
7+	1.1960	49	71	77	119	77	119	77	119
Total		20300	10013	78182	24263	44585	18047	44585	18047
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1997 F-factor: 1.0000 Reference F: 0.9212

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0397	1186	280	33597	6215	0	0	0	0
2	0.4121	8148	2727	26436	6953	26436	6953	26436	6953
3	0.9896	8295	3832	14334	6216	14334	6216	14334	6216
4	1.0927	1442	946	2352	1468	2352	1468	2352	1468
5	1.1904	1232	1149	1916	1880	1916	1880	1916	1880
6	1.1960	466	497	722	652	722	652	722	652
7+	1.1960	86	125	134	208	134	208	134	208
Total		20855	9556	79491	23593	45894	17378	45894	17378
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : SINGOPT3
Date and time : 10SEP95:08:24
Computation of ref. F: Simple mean, age 2 - 5
Prediction basis : F factors

Table 4.2.15

Whiting in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

Prediction with management option table

Year: 1995					Year: 1996					Year: 1997	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.9212	28678	22463	13490	0.0000	0.0000	24263	18047	0	35227	29011
.	.	.	.	.	0.1000	0.0921	.	18047	1426	33548	27333
.	.	.	.	.	0.2000	0.1842	.	18047	2732	32016	25800
.	.	.	.	.	0.3000	0.2764	.	18047	3929	30616	24400
.	.	.	.	.	0.4000	0.3685	.	18047	5028	29335	23120
.	.	.	.	.	0.5000	0.4606	.	18047	6037	28163	21947
.	.	.	.	.	0.6000	0.5527	.	18047	6966	27088	20872
.	.	.	.	.	0.7000	0.6448	.	18047	7821	26101	19886
.	.	.	.	.	0.8000	0.7370	.	18047	8610	25195	18979
.	.	.	.	.	0.9000	0.8291	.	18047	9339	24361	18146
.	.	.	.	.	1.0000	0.9212	.	18047	10013	23593	17378
.	.	.	.	.	1.1000	1.0133	.	18047	10637	22885	16670
.	.	.	.	.	1.2000	1.1054	.	18047	11215	22231	16016
.	.	.	.	.	1.3000	1.1976	.	18047	11753	21627	15411
.	.	.	.	.	1.4000	1.2897	.	18047	12252	21067	14852
.	.	.	.	.	1.5000	1.3818	.	18047	12718	20548	14333
.	.	.	.	.	1.6000	1.4739	.	18047	13151	20067	13851
.	.	.	.	.	1.7000	1.5660	.	18047	13557	19619	13404
.	.	.	.	.	1.8000	1.6582	.	18047	13936	19203	12987
.	.	.	.	.	1.9000	1.7503	.	18047	14291	18814	12599
.	.	.	.	.	2.0000	1.8424	.	18047	14624	18452	12236
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : PREDI3
Date and time : 10SEP95:08:29
Computation of ref. F: Simple mean, age 2 - 5
Basis for 1995 : F factors

Table 4.2.16 : Celtic Sea Whiting. Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class	1991	1992	1993	1994	1995
Stock No. (thousands) of one-year-olds	68403	48118	17836	33597	33597
Source	VPA	VPA	VPA	GM	GM
Status Quo F:					
% in 1995 catch	31.5	45.5	10.9	2.1	-
% in 1996 catch	17.4	28.1	20.6	27.2	2.8
% in 1995 SSB	29.4	44.3	16.7	0.0	-
% in 1996 SSB	15.8	24.1	18.6	38.5	0.0
% in 1997 SSB	3.8	10.8	8.4	35.8	40.0

GM = geometric mean recruitment

Celtic Sea Whiting : Year-class % contribution to a) 1996 landings and b) 1997 SSB

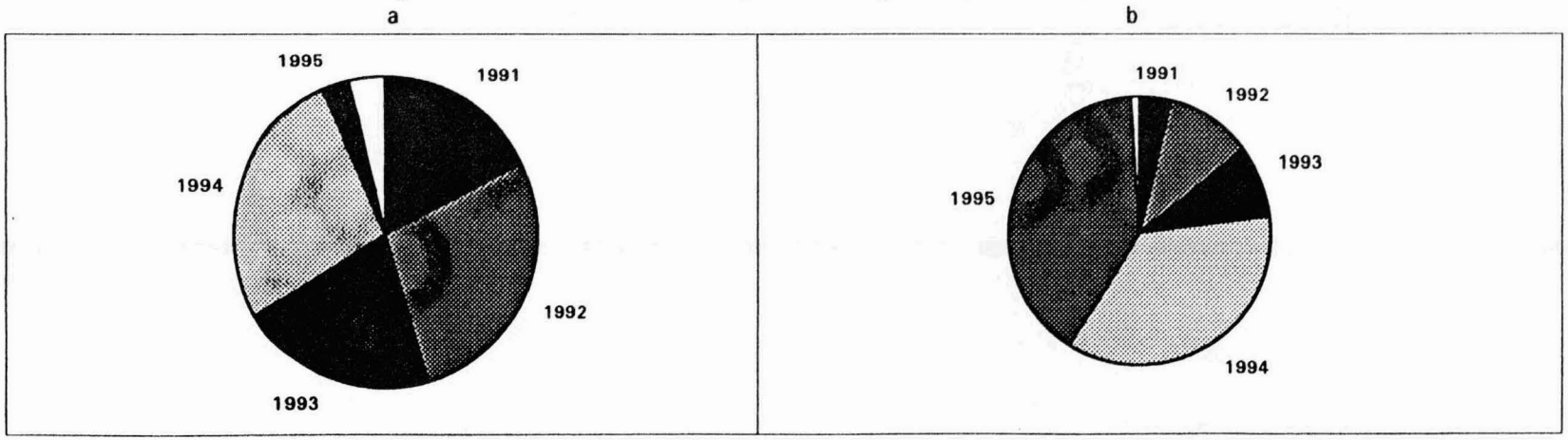


Figure 4.2.1 Celtic Sea Whiting
Retrospective analysis in mean F and relevant SSB with different levels of shrinkage.

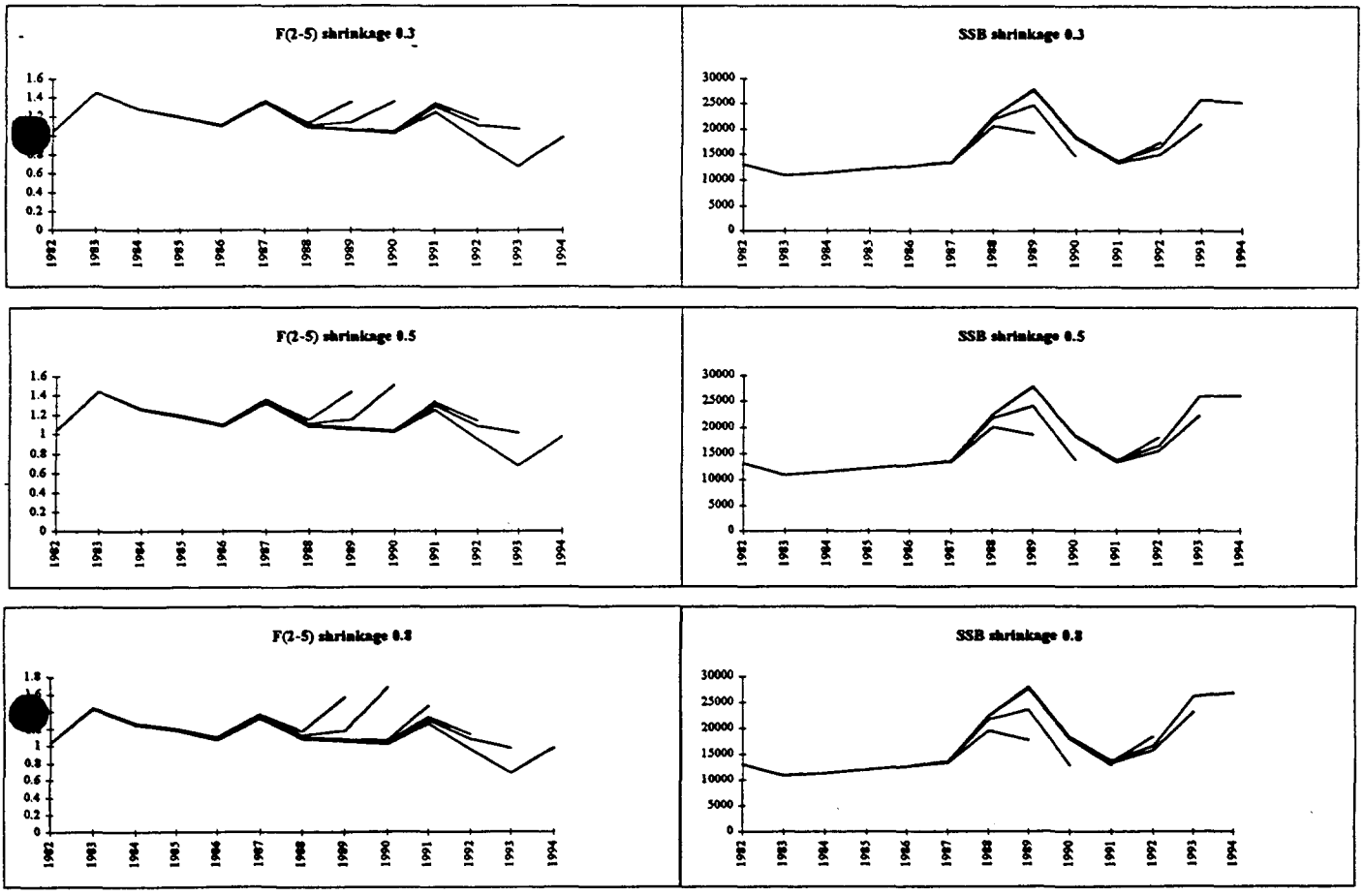


Figure 4.2.2 Celtic Sea Whiting Log catchability residual plots - XSA final run
French Lorient gadoids fleet

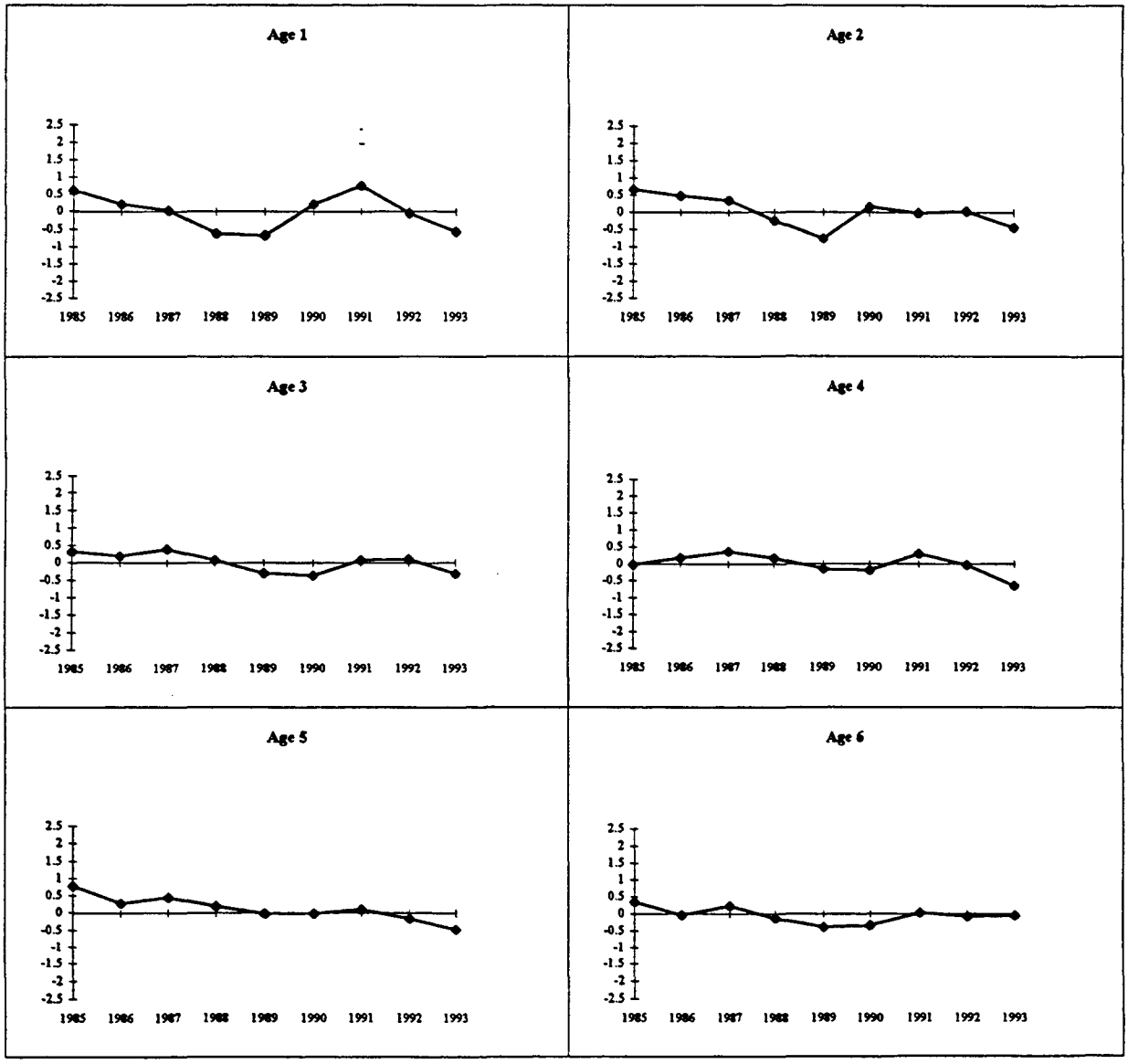
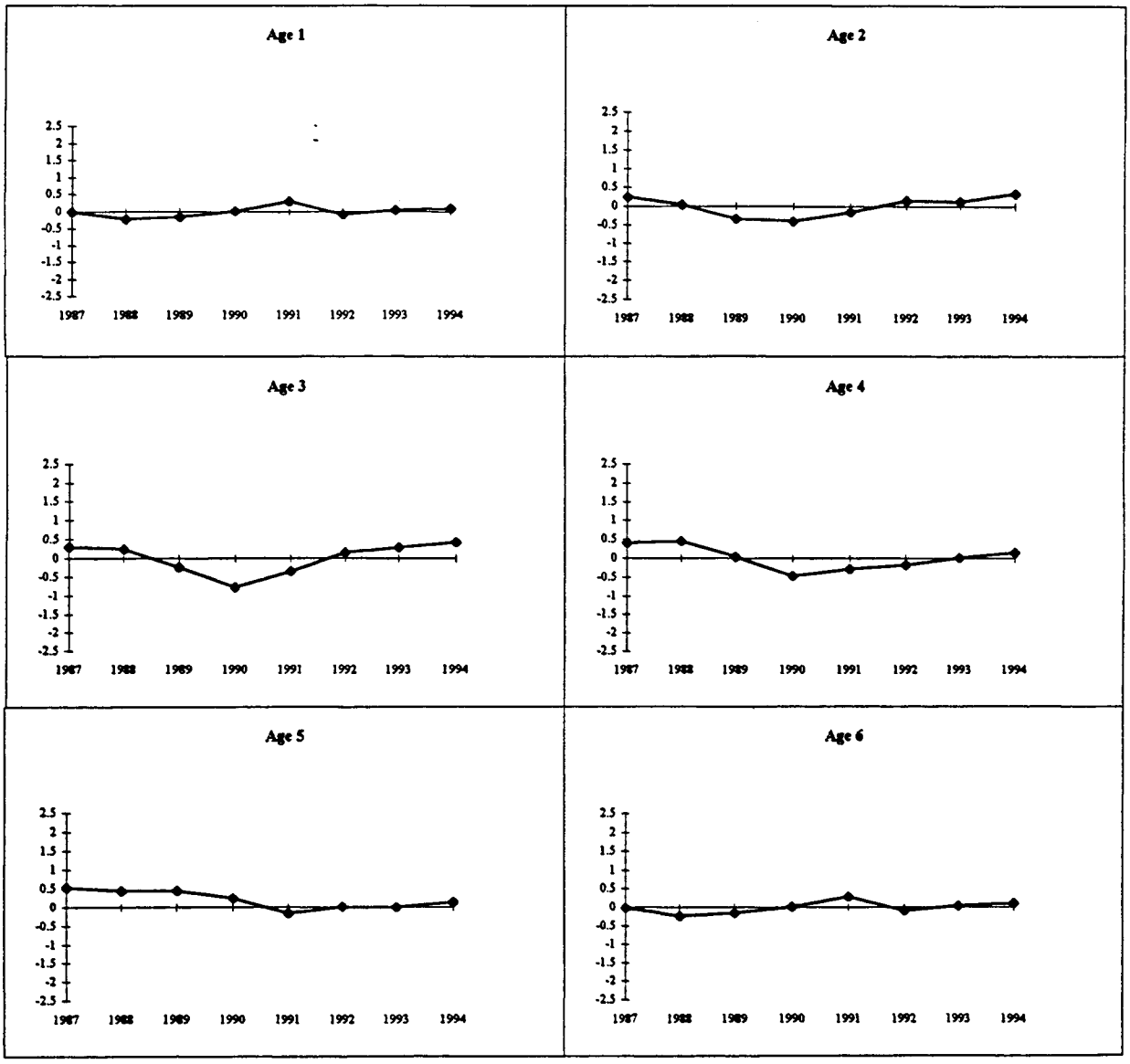


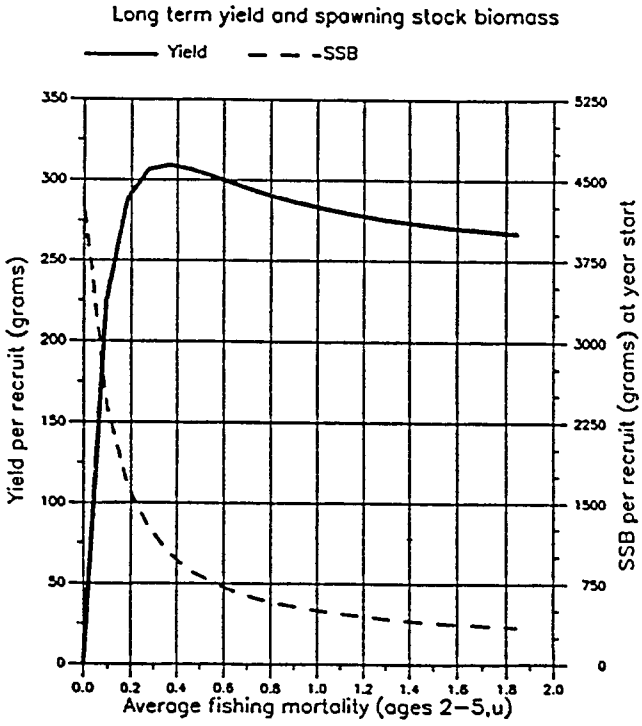
Figure 4.2.2 (cont'd) : Celtic Sea Whiting *Nephrops* fleet Log catchability residual plots - XSA final run

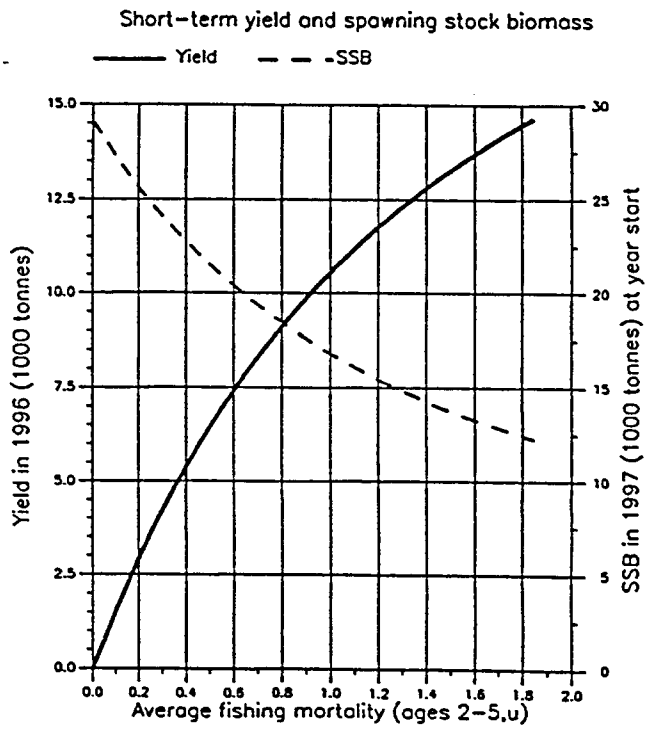


FISH STOCK SUMMARY

Figure 4.2.3 STOCK: Whiting in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

10–9–1995

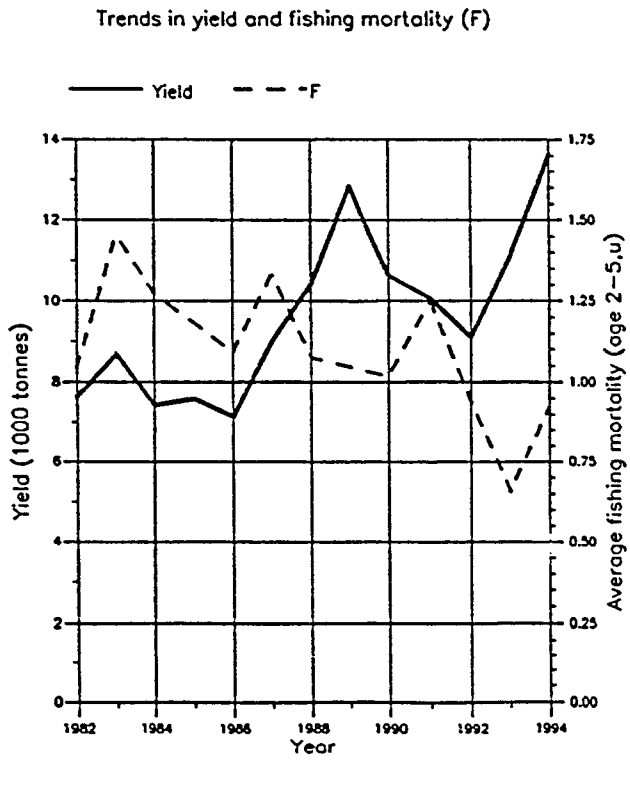




FISH STOCK SUMMARY

STOCK: Whiting in the Celtic Sea (Fishing Areas VIIf, VIIg and VIIh)

8–9–1995



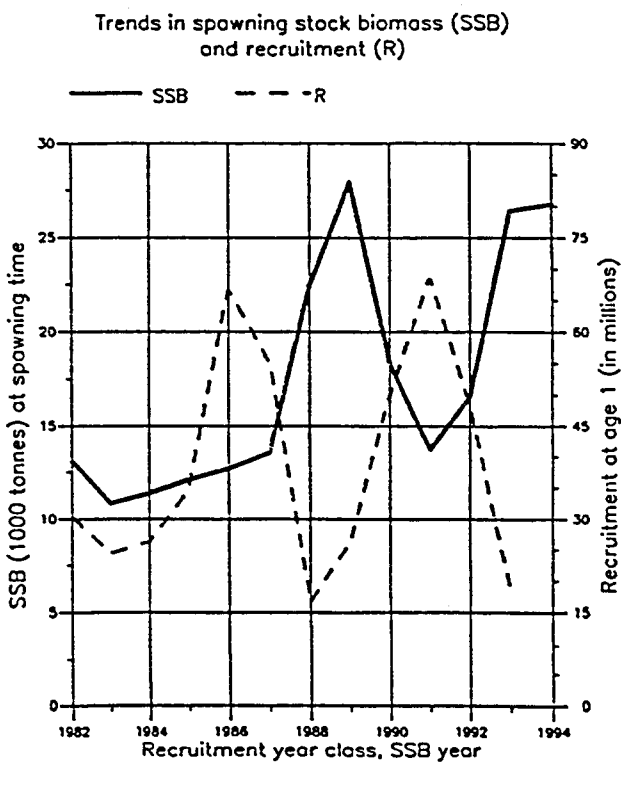


Figure 4.2.4 Celtic Sea Whiting: stock-recruitment

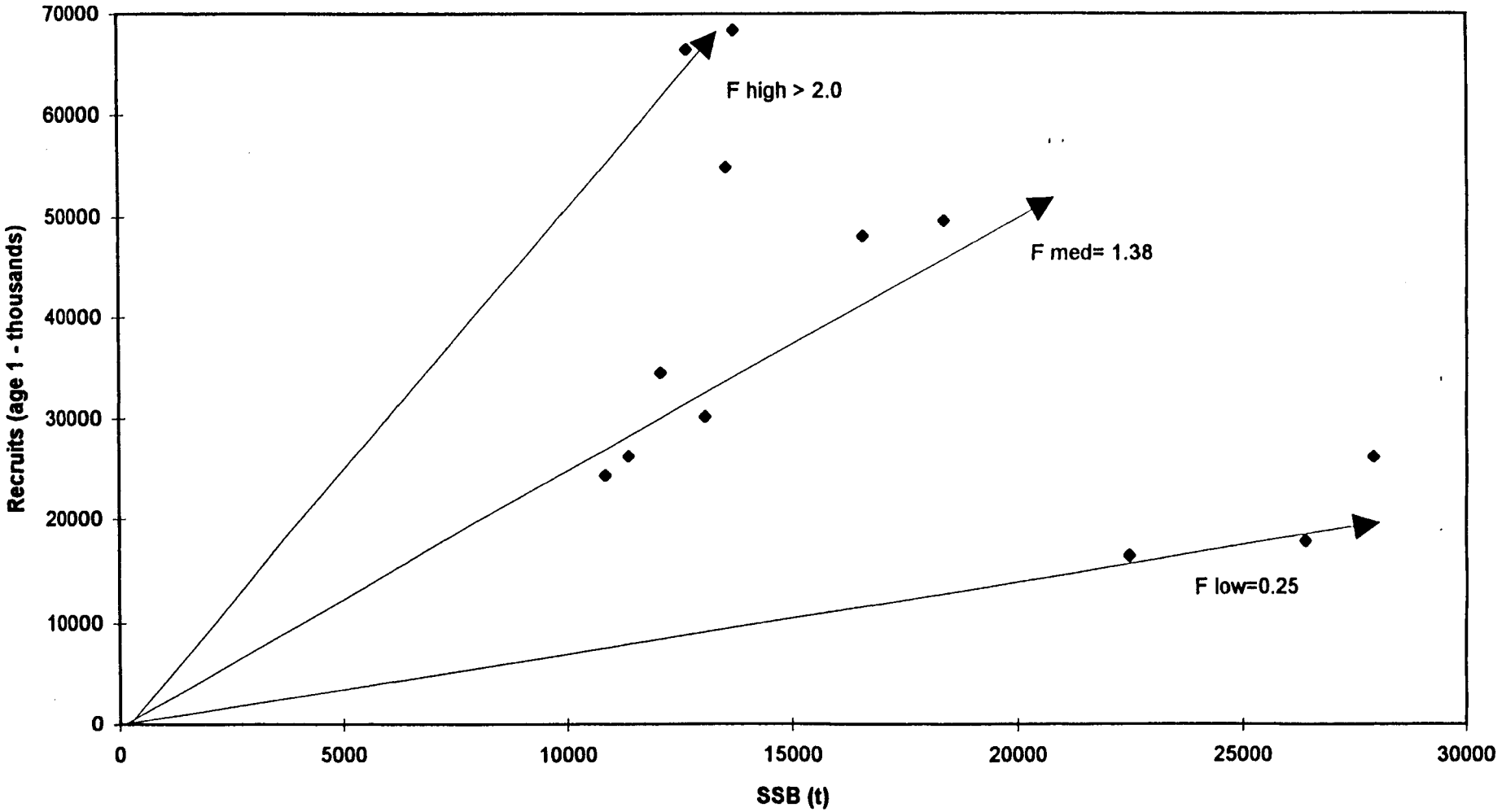
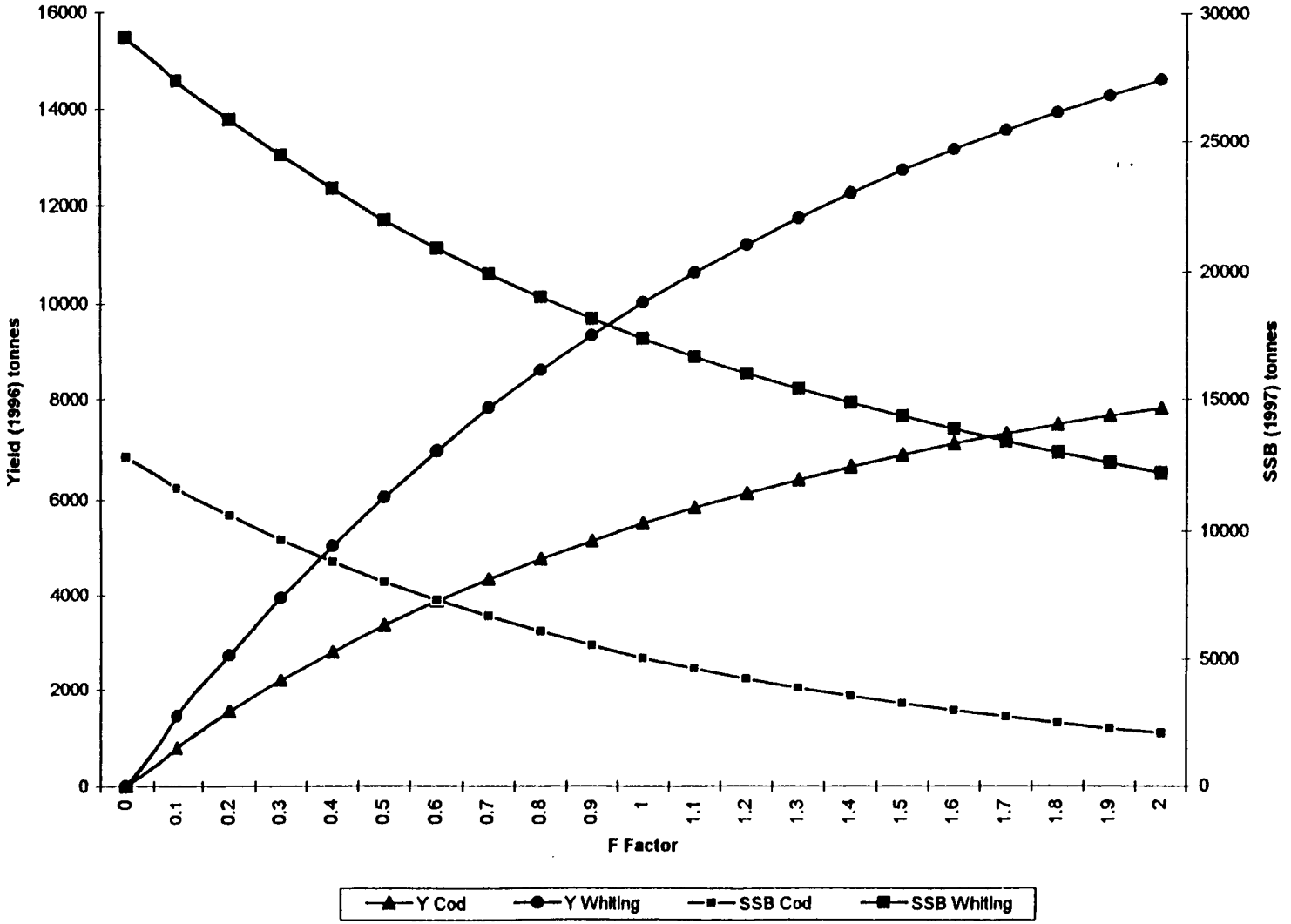


Figure4.2.5 Celtic Sea Cod and Whiting: Combined Short Term Forecasts assuming Status Quo in 1995



4.3 Sole in the Celtic Sea (Divisions VIIf,g)

4.3.1 Landings, Effort and CPUE Trends

National landings data reported to ICES are given in Table 2.1.4. The 1993 total landings (926 t) was modified to 928 t due to an increase in reported landings by France. Total international landings as used by the Working Group were 1016 t in 1994, 8% less than the TAC of 1,100 t (Table 4.3.1).

The problem of some French landings being estimated for 1994 is not important for this stock, since only 2% of the total catch figure was estimated.

There are no discard data and no information on the level of misreporting for this stock.

Although UK vessels were subject to monthly landings quotas, no restrictions were implemented for the sole fisheries during 1994.

CPUE and effort series were available for the Belgian beam trawl fleet and the UK (England and Wales) beam and otter trawl fleets (Tables 4.3.2 and 4.3.3). As in previous years, the Belgian series is corrected using a relationship between fishing power (P) and brake horsepower ($P = 0.00204\ BHP^{1.23}$). (NB. the data tables presented in last year's report were not the correct ones, being those from the 1993 WG report).

The UK effort series refer to Division VIIf only. They show a decrease in otter and beam trawl effort from 1993 to 1994 of 31% and 7% respectively. Although the Belgian 1994 effort was 23% higher than in 1993, the 1994 level is still 35% lower than the peak values of the late 1980s.

The 1994 CPUE series for the Belgian and UK beam trawl fleets show a decrease of 8% and 11% respectively compared to 1993. However, 1994 CPUE values for the UK otter trawl fleet show a 64% increase in Division VIIf and 8% in VIIg(east), compared to 1993. Recent catch rates are much lower than those observed in the early 1980s.

4.3.2 Age and length composition and weight at age

Quarterly data for 1994 were available for catch numbers and weight at age, by sex, for the Belgian and English fleets. These comprise more than 85% of the international landings. The data were combined and then raised to the total international catch. Catch weights at age for 1994 were calculated, quadratically smoothed, and then adjusted to give a correct SOP. The SOP correction was 1.03.

Inspection of historical data showed anomalies in SOP factors in most years. Inspection of the Irish Sea and Bristol Channel Working Group reports for the years 1978-1980 revealed that catch and stock weights at age were constant throughout the time series. In this case, it is appropriate to modify the weights at age. Therefore, the mean weights in the catch have been revised to obtain 100% SOP checks.

As in last year's assessment, stock weights at age were the catch weights of the Belgian beam trawl fleet in the first quarter. These are rather noisy between ages, and have been smoothed by fitting with a Gompertz growth curve:

$$W(t) = 6.023 * \exp(4.953 (1-\exp(-0.33\ t)))$$

Catch numbers at age are given in Table 4.3.4, and weights at age in the catch and the stock are given in Tables 4.3.5 and 4.3.6.

Annual length compositions are given by fleet in Table 4.3.7. At some ages, the weights in the stock are higher than the weights in the catch. This is because sole caught at spawning concentrations in the 1 quarter are heavier (10 to 15 %) than after spawning, later in the year.

4.3.3 Natural mortality and maturity at age

Natural mortality was assumed to be 0.1 for all ages and years, and knife-edged maturity to be attained at age 3, as in previous assessments. The assumptions that 25% of natural mortality occurs before spawning remains unchanged. The seasonal pattern of international landings was reviewed, and the assumption in previous assessments, that 33% of annual mortality takes place prior to spawning (which occurs in April-May), was found to be reasonable.

4.3.4 VPA tuning

Data screening

General approaches and methods are described in Section 1.5.1. The age range for the analyses was 1-10+, as in previous assessments. However, there is no commercial catch at age 1.

VPA tuning data were available for Belgium beam-trawlers (1971-1994), the UK Beam trawl fleet from Division VIIf (1987-1994), and from the UK Corystes beam trawl survey (1988-1994) (Table 4.3.8). The UK commercial fleet tuning data have been revised to give a beam trawl set, based on length samples from beam trawl catches used with an all-gear ALK. These data could only be separated from the otter trawl fleet length samples for the years after 1987, which makes the series 2 years shorter than in previous assessments. A re-run of last year's VPA with this revised data set shows a marginally lower fishing mortality for 1993 compared to last year's run.

A preliminary inspection of the quality of international catch-at-age data was carried out using separable VPA with a reference age of 4, terminal F=0.5 and terminal S=0.8. As last year, the log-catch ratios for the fully recruited ages (3 and older) did not show any patterns or large residuals (available in ICES stock files).

As last year, the 0-group series from the survey was removed, as well as the data for ages 4 and upwards, since these data were sparse and contributed little to the assessment.

The tuning data were examined for trends in catchability by carrying out Laurec-Shepherd (L/S) tuning runs without shrinkage, using data for each of the three fleets individually. Although catchability was variable in the less well-sampled ages, examination of the residuals and regression slopes revealed no apparent trends (available in ICES files).

Exploratory XSA-runs

Trial runs with q dependent on year class strength for ages less than 3 gave slightly higher standard errors for age 3, hence there was no need to change last year's settings for this parameter. A comparison of catchability values at age suggested that it was not appropriate to change the "q-plateau".

To test for the effect of shrinkage on the analysis, F shrinkage SEs of 0.3, 0.5, 0.8 and 1.0 were used in further XSA runs. The trends in mean F for these runs (in ICES stock files) show very little influence of shrinkage. Retrospective analyses showed that the level of shrinkage has no effect on reducing the bias in retrospective patterns of mean F or SSB (Figure 4.3.2a&b). The shrinkage value of 0.5 used in last year's assessment was therefore chosen for the final run.

Final XSA-run

The settings for the final XSA-run were the same as last year, ie: catchability dependent on stock size for ages < 4, catchability independent of age for ages >= 7 and a shrinkage of 0.5.

The residuals of the final XSA-run are shown in Figure 4.3.2.

The residuals from the commercial fleets at age 2 are larger than the survey residuals at the same age, probably because age 2 is not well represented in the commercial catches. The fully recruited ages (3 and older) did not show any patterns or large residuals. The poor survey residuals at age 5 are resulted in the removal of survey-data above age 4.

The XSA tuning diagnostics are given in Table 4.3.9.

For age 1 the survey is given 22% of the weight, the rest being provided by the population shrinkage mean (no fishing mortality, because there is no commercial catch at this age). For age group 2, the weight is almost equally divided between the survey and the P-shrinkage, and both give approximately the same estimates of survivors. From age group 3 the commercial fleets start to contribute with percentages between 10 and 20. For older ages, the Belgian beam trawl fleet tends to have the highest weight, and gives the highest estimates of survivors in most ages.

4.3.5 VPA results

The final VPA output is given in Table 4.3.10 (fishing mortalities) and Table 4.3.11 (stock numbers). A summary of the VPA is given in Table 4.3.12 and trends in yield, fishing mortality, recruitment and spawning stock biomass are shown in Figures 4.3.3 a&b.

The VPA estimates indicate that F has continually increased from about 0.25 in the 1970's to a peak of 0.67 in 1990. Since then F has varied between 0.40 and 0.50. The lower mean Fs in 1991 and 1992 may be explained by the greater time spent by beam-trawl fleets in other fishing areas. For comparison, a reference F_{3-7} (for the ages which are most abundant in catches) has been supplied together with the standard F_{4-8} used for the prediction.

The recruitment has fluctuated about the average value without any trend. However, the 1989 year class (9.3 millions) has been outstanding and is of similar size to the 1970 year class (9.2 millions), not shown in the standard graphs (Table 4.3.12). SSB is estimated to have declined to below half the level in the 1970's, but temporally increased in 1992 due to the contribution of the good 1989 year class.

4.3.6 Recruitment

As the survey data have already been included in the XSA analysis, giving improved estimation of the recruiting year classes, the WG accepted the 1992 year-class estimates.

An RCT3 run was carried out, using 0-group survey indices for 1988-1994. However, there are only 4 data points available to fit the regression (only preliminary data from the 1995 September Corystes beam trawl survey were available at the meeting). The 1-group index, being the only one available for the 1993 estimates, has already been accounted in XSA. Therefore and it was concluded the RCT3 results are not suitable for prediction. The 1-group index has already been accounted for in XSA.

Taking into account that in the VPA almost 80% of the 1993 year class is estimated by population shrinkage, it was decided to replace the XSA estimates by the GM (4.8 millions).

The GM recruitment for age 1 was also used for the 1994 and 1995 year classes.

4.3.7 Yield per recruit and catch prediction

Input data for yield per recruit and catch prediction calculations are given in Table 4.3.13. The fishing pattern is the average of the years 1992-1994, re-scaled to mean F(1994). Weight at age in the catch and in the stock are averages for the years 1992-1994. Stock numbers at ages 3-10+ in 1994 were taken from the VPA.

Results of yield per recruit analysis are given in Table 4.3.14 and are plotted in Figure 4.3.3c. $F_{0.1}$ and F_{max} are estimated at 0.10 and 0.24 respectively which are 20% and 48% of F in 1994.

A plot of recruitment against spawning stock size is given in Figure 4.3.4, providing the values for F_{high} (0.45), F_{med} (0.33) and F_{low} (0.17). Current F is estimated to be just above F_{high}. However the scatter of points indicate that recruitment seems to be independent of SSB.

Results of the catch prediction are given in Tables 4.3.15 and 4.3.16 and are shown in Figure 4.3.3d. For 1995, it is assumed that fishing mortality will continue at the 1994 level (F_{4-8u} = 0.50), as this gives catches just under the 1995 TAC of 1,100 t.

The *status quo* predictions for landings in 1995, 1996 and 1997 are 1,027 t, 966 t and 930 t respectively. The SSB is predicted to decrease slightly from 2,300t in 1995 to 2,200t in 1996 and 2,100t in 1997, being just above the historically lowest level (2,000t) observed in 1991.

The percentage contribution of recent year classes to the catch in 1996 and the SSB in 1997 are shown in Table 4.3.17. The assumed GM recruitment accounts for 30% of the landings in 1996 and 47% of the 1997 SSB. However, in view of the stability of recruitment in this stock, this should not undermine the prediction.

4.3.8 Sensitivity analysis

A sensitivity analysis has been carried out, using a linear method described by Cook (1993) and used at previous meetings of the Working Group on Assessment of North Sea and Skagerrak demersal species. The input values are presented in Table 4.3.18. It should be noted that this model calculates SSB at the start of the year, whereas the prediction calculates SSB at spawning time. The results are given in Figures 4.3.5-7. These indicate that, apart from the effect of effort multipliers for 1995 and 1996, the estimates of catch and SSB for 1995 and 1996 are most sensitive to the population size and weight of 3 to 6 year olds.

The cumulative probability distribution is given in Figure 4.3.7. ACFM attention is drawn to the fact that SSB is here calculated at the first of January and, i.e. 2,000 t SSB at spawning time is roughly equivalent to 2,400 t at the first of January.

4.3.9 Comments on this assessment

As last year, the VPA is based on two commercial fleet data and an additional survey data-series. However, the vessel used in this survey is large and not able to fish in nearshore areas. Consequently, the 0-group index may not be a reliable representation of abundance.

Although the revision of the UK (England & Wales) beam trawl commercial fleet series (see section 4.3.4) reduced its time series by 2 years, its contribution to the different age groups in XSA were only marginally different.

It appears that there is a slight over-estimation of F for this stock in recent years, and under-estimation of SSB.

4.3.10 Management considerations

During the period 1978-1986 landings increased accompanying an increasing trend in fishing mortality.

Spawning stock biomass has been declining since the early 1970's but a good 1989 year class has temporally halted the decline. Fishing mortality has recently been high, and present effort will cause SSB to decline to just above the historic low.

There is no evidence to suggest that recruitment is reduced at the low levels of SSB observed in the series

Table 4.3.1. Celtic Sea SOLE. Divisions VIIf and VIIg. Nominal landings (tonnes), 1982-1994. Data used by the Working Group

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994[1]
Belgium	819	871	786	786	1,092	704	725	660	689	839	516	512	611
France	100	124	115	126	92	72	89	97	100	80	136	103	94
Ireland	3	48	4	13	12	9	15	32	41	N/A	4	28	47
UK(Engl.& Wales)	206	330	361	403	404	437	317	203	359	395	325	285	264
Others	-	-	-	-	-	-	-	-	-	10	-	-	-
Total	1,128	1,373	1,266	1,328	1,600	1,222	1,146	992	1,189	1,324	981	928	1,016
Unallocated	-	-	-	-	-	-	-	-	-	-217	-	-	-
Total used by Working Group in Assessment	1,128	1,373	1,266	1,328	1,600	1,222	1,146	992	1,189	1,107	981	928	1,016

[1]Preliminary

Table 4.3.2. Celtic Sea Sole. Indices of effort.

Year	England & Wales Otter trawl	England & Wales Beam trawl[1]	Belgium Beam trawl[2]
1971	-	-	11.06
1972	45.7	-	8.44
1973	45.3	-	17.39
1974	38.9	-	18.83
1975	33.5	-	16.38
1976	25.6	-	28.07
1977	27.2	-	24.11
1978	27.1	-	18.09
1979	23.8	-	18.90
1980	26.4	-	29.02
1981	24.1	-	35.38
1982	19.2	-	28.77
1983	17.6	-	34.95
1984	23.2	-	33.48
1985	25.2	18.70	40.49
1986	21.2	20.72	52.46
1987	24.4	38.76	37.23
1988	20.1	25.62	42.92
1989	17.6	20.26	53.58
1990	22.6	30.77	40.27
1991	18.6	40.81	18.05
1992	16.0	35.78	25.48
1993	13.8	39.64	28.13
1994	9.5	36.99	34.52

[1]Division VIIf only - Fishing hours (x10^3) corrected for fishing power
[2]Fishing hours (x 10^3) corrected for fishing power using P = 0.000204 BHP^1.23

Table 4.3.3. Celtic Sea SOLE . CPUE indices.

Year	England & Wales otter trawl[1]		Belgium BT[2]	England & Wales BT[1]
	Division VIIf	Division VIIg[3]	Division VIIf + g	Division VIIf
1971	-	-	47.92	-
1972	2.42	2.11	37.06	-
1973	2.45	0.98	39.47	-
1974	2.10	1.83	37.81	-
1975	1.82	1.79	31.41	-
1976	2.02	1.30	30.50	-
1977	1.84	1.21	27.90	-
1978	1.82	1.17	23.35	13.99
1979	1.80	1.15	33.19	14.83
1980	1.86	1.55	29.73	18.99
1981	1.45	0.60	24.03	13.58
1982	1.73	0.56	25.93	11.79
1983	2.22	1.14	22.18	13.50
1984	1.53	1.70	20.78	13.59
1985	1.55	1.55	17.94	12.52
1986	1.38	0.99	17.83	10.94
1987	0.94	1.15	17.32	7.31
1988	0.62	0.27	15.29	4.39
1989	0.99	0.87	11.33	5.38
1990	0.76	0.67	15.64	5.98
1991	0.69	0.85	24.24	4.80
1992	1.00	1.25	18.57	4.14
1993	0.55	0.25	15.21	4.80
1994	0.90	0.27	13.94	4.27

[1]Kg/hr corrected for GRT.

[2]Kg/hr corrected for fishing power using P = 0.000204 BHP^1.23 (revised)

[3]Division VIIg (East).

Table 4.3.4

Run title : Sole, Celtic Sea (run: XS1/002)

At 7-Sep-95 17:21:01

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1971,	1972,	1973,	1974,
AGE				
1,	0,	0,	0,	0,
2,	388,	538,	363,	158,
3,	271,	897,	1878,	445,
4,	1347,	312,	746,	877,
5,	628,	666,	304,	418,
6,	435,	327,	351,	212,
7,	539,	212,	119,	243,
8,	766,	231,	110,	99,
9,	378,	312,	116,	111,
+gp,	1226,	726,	644,	550,
TOTALNUM,	5978,	4221,	4631,	3113,
TONSLAND,	1861,	1278,	1391,	1105,
SOPCOF %,	100,	100,	100,	100,

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	123,	314,	314,	320,	338,	666,	611,	342,	643,	676,
3,	298,	840,	438,	745,	577,	985,	685,	832,	1072,	850,
4,	349,	564,	349,	341,	769,	887,	804,	309,	725,	609,
5,	662,	616,	271,	155,	214,	592,	405,	467,	282,	545,
6,	315,	563,	244,	160,	159,	182,	382,	280,	347,	185,
7,	114,	263,	404,	100,	203,	63,	152,	207,	224,	278,
8,	106,	132,	120,	199,	128,	97,	122,	92,	191,	107,
9,	70,	198,	28,	71,	158,	101,	95,	111,	52,	47,
+gp,	385,	466,	365,	174,	175,	355,	386,	326,	319,	274,
TOTALNUM,	2422,	3956,	2533,	2265,	2721,	3928,	3642,	2966,	3855,	3571,
TONSLAND,	919,	1350,	961,	780,	954,	1314,	1212,	1128,	1373,	1266,
SOPCOF %,	100,	100,	100,	100,	100,	100,	100,	100,	100,	100,

Run title : Sole, Celtic Sea (run: XS1/002)

At 7-Sep-95 17:21:01

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	201,	503,	328,	547,	498,	284,	1666,	497,	397,	289,
3,	1511,	1320,	988,	482,	1209,	1019,	724,	1728,	876,	831,
4,	786,	1194,	823,	914,	624,	1205,	585,	642,	1117,	774,
5,	579,	536,	596,	459,	645,	409,	446,	403,	333,	889,
6,	304,	365,	282,	402,	246,	463,	130,	243,	194,	287,
7,	103,	197,	212,	132,	195,	141,	137,	56,	158,	147,
8,	144,	89,	103,	81,	85,	118,	49,	63,	66,	68,
9,	75,	105,	63,	70,	25,	51,	36,	34,	88,	43,
+gp,	247,	334,	186,	279,	106,	132,	158,	93,	110,	161,
TOTALNUM,	3950,	4643,	3581,	3366,	3633,	3822,	3931,	3759,	3339,	3489,
TONSLAND,	1328,	1600,	1222,	1146,	992,	1189,	1107,	981,	928,	1016,
SOPCOF %,	100,	100,	100,	100,	100,	100,	100,	100,	100,	100,

Table 4.3.5

Run title : Sole, Celtic Sea (run: XS1/002)

At 7-Sep-95 17:21:09

Table 2 Catch weights at age (kg) YEAR,	1971,	1972,	1973,	1974,
AGE				
1,	.1000,	.1000,	.1000,	.1000,
2,	.1460,	.1340,	.1510,	.1540,
3,	.1470,	.1820,	.2080,	.1990,
4,	.1900,	.2270,	.2610,	.2470,
5,	.2300,	.2820,	.3040,	.2990,
6,	.3470,	.3170,	.3690,	.3870,
7,	.4110,	.3350,	.3730,	.4570,
8,	.3670,	.4030,	.4280,	.4820,
9,	.3690,	.3850,	.5350,	.5990,
+gp,	.4660,	.5450,	.5830,	.6250,
SOPCOFAC,	.9999,	1.0004,	1.0000,	.9995,

Table 2 Catch weights at age (kg) YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	.1000,	.1000,	.1000,	.1000,	.1000,	.1000,	.1000,	.1000,	.1000,	.1000,
2,	.1780,	.1860,	.1860,	.1630,	.1840,	.1660,	.1670,	.1800,	.1860,	.1790,
3,	.1980,	.2080,	.2200,	.2230,	.2190,	.2230,	.2080,	.2260,	.2470,	.2280,
4,	.2520,	.2460,	.2740,	.2930,	.2650,	.2920,	.2780,	.2940,	.3120,	.3000,
5,	.3240,	.3100,	.3670,	.3950,	.3960,	.3730,	.3450,	.3960,	.3840,	.3990,
6,	.3760,	.3710,	.4000,	.4420,	.4580,	.4820,	.4080,	.4980,	.4600,	.4840,
7,	.5730,	.4300,	.4870,	.5200,	.5280,	.5550,	.4800,	.5120,	.5520,	.5640,
8,	.4670,	.4490,	.4730,	.5170,	.5320,	.5080,	.5370,	.5740,	.5970,	.5860,
9,	.5150,	.4670,	.5920,	.5550,	.6320,	.6720,	.6690,	.5820,	.5220,	.7380,
+gp,	.6910,	.6740,	.6650,	.7820,	.7350,	.7450,	.6390,	.7360,	.7200,	.7590,
SOPCOFAC,	1.0003,	.9995,	1.0008,	.9993,	1.0003,	.9997,	.9998,	.9999,	1.0000,	.9995,

Run title : Sole, Celtic Sea (run: XS1/002)

At 7-Sep-95 17:21:10

Table 2 Catch weights at age (kg) YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	.1000,	.1000,	.1000,	.1000,	.1000,	.1000,	.1000,	.1000,	.1000,	.1000,
2,	.1900,	.1650,	.1690,	.1630,	.1370,	.1730,	.1770,	.1710,	.1490,	.1620,
3,	.2150,	.2240,	.2150,	.2190,	.1760,	.2180,	.2500,	.2040,	.1950,	.1990,
4,	.2920,	.2980,	.2800,	.2570,	.2450,	.2780,	.3070,	.2730,	.2540,	.2670,
5,	.4080,	.4100,	.3980,	.3780,	.3250,	.3540,	.3640,	.3480,	.3430,	.3110,
6,	.4720,	.4670,	.4710,	.4600,	.4600,	.3850,	.4470,	.3920,	.4170,	.3690,
7,	.4790,	.5420,	.5140,	.5720,	.4870,	.4660,	.4910,	.4690,	.4500,	.4690,
8,	.5480,	.5790,	.6160,	.6170,	.5860,	.5420,	.5480,	.4940,	.4800,	.5090,
9,	.6240,	.6840,	.6930,	.6030,	.6000,	.6340,	.6220,	.4670,	.5100,	.4690,
+gp,	.7290,	.7350,	.7400,	.6830,	.7090,	.7400,	.7130,	.6390,	.6480,	.5700,
SOPCOFAC,	1.0005,	.9998,	1.0000,	.9997,	1.0004,	1.0000,	1.0017,	1.0000,	1.0003,	.9993,

Table 4.3.6

Run title : Sole, Celtic Sea (run: XS1/002)

At 7-Sep-95 17:21:24

Table 3 Stock weights at age (kg)

YEAR,	1971,	1972,	1973,	1974,
AGE				
1,	.0900,	.0900,	.0900,	.0900,
2,	.0760,	.1130,	.1130,	.1130,
3,	.1360,	.1570,	.1420,	.1590,
4,	.1900,	.2220,	.2030,	.2210,
5,	.2390,	.2980,	.2630,	.3050,
6,	.4060,	.3510,	.3340,	.4500,
7,	.4720,	.3520,	.3220,	.4480,
8,	.3890,	.5930,	.4000,	.4640,
9,	.3460,	.4170,	.5390,	.6240,
+gp,	.5820,	.6010,	.5820,	.6710,

Table 3 Stock weights at age (kg)

YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,
2,	.1130,	.1130,	.1450,	.1130,	.1130,	.1130,	.1130,	.1130,	.1130,	.1180,
3,	.1410,	.1600,	.1740,	.1670,	.1630,	.1570,	.1590,	.1640,	.1750,	.1730,
4,	.2150,	.2100,	.2360,	.2570,	.2550,	.2380,	.2320,	.2550,	.2620,	.2740,
5,	.2950,	.2690,	.3660,	.3600,	.3920,	.3540,	.3060,	.3560,	.3700,	.4290,
6,	.3530,	.3540,	.3920,	.4130,	.4370,	.3940,	.3850,	.4870,	.4880,	.5170,
7,	.5930,	.4320,	.4540,	.5210,	.4850,	.6220,	.4620,	.5430,	.6330,	.6410,
8,	.4230,	.4620,	.5050,	.5080,	.5950,	.5560,	.5510,	.6100,	.6060,	.6130,
9,	.4650,	.4250,	.9070,	.5600,	.6570,	.7040,	.7370,	.7660,	.4640,	.8360,
+gp,	.7110,	.7280,	.7010,	.7830,	.6970,	.7720,	.6620,	.8560,	.8230,	.9780,

Run title : Sole, Celtic Sea (run: XS1/002)

At 7-Sep-95 17:21:24

Table 3 Stock weights at age (kg)

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,
2,	.1130,	.1130,	.1130,	.1130,	.1130,	.1130,	.1130,	.1130,	.1480,	.1130,
3,	.1750,	.1800,	.1530,	.1580,	.1520,	.1640,	.1790,	.1840,	.1960,	.1350,
4,	.2680,	.2730,	.2420,	.2330,	.2270,	.2470,	.2300,	.2650,	.2670,	.2270,
5,	.4720,	.3980,	.3610,	.3630,	.3080,	.3690,	.3560,	.3880,	.3920,	.3290,
6,	.4330,	.4620,	.4730,	.4660,	.4650,	.4760,	.5360,	.4980,	.4700,	.4300,
7,	.4620,	.5460,	.4680,	.6870,	.5460,	.5230,	.3760,	.7510,	.4920,	.5210,
8,	.4800,	.6360,	.5870,	.6870,	.5260,	.7530,	.8590,	.7540,	.5760,	.5990,
9,	.9440,	.8900,	.8200,	.6760,	.5420,	.8470,	.7350,	.4750,	.6360,	.6610,
+gp,	.7990,	.8430,	.8380,	.8170,	.7540,	.9740,	.6550,	.8960,	.7280,	.7610,

Table 4.3.7 Celtic Sea Sole . Annual length distributions by fleet 1994.

Length (cm)*	UK (England & Wales) Beam trawl	UK (England & Wales) All gears (minus beam)	Belgium All gears
21		44	0
22	42	190	0
23	1187	614	0
24	8269	2174	72201
25	13210	3214	222462
26	21816	7512	166374
27	37401	7735	233029
28	46755	9346	259157
29	45144	8090	244105
30	45798	8613	208600
31	58770	17974	166592
32	54687	6458	137854
33	49451	5497	124948
34	43920	4588	85305
35	39724	5926	65984
36	32598	5681	35274
37	26873	4196	23070
38	21409	4191	16424
39	13266	2620	7644
40	9854	2622	7323
41	9164	1612	5650
42	10489	1777	6072
43	6983	951	3863
44	3938	813	2366
45	4052	482	1275
46	3217	280	575
47	1002	14	253
48	791	61	0
49	119	268	210
50	126	0	199
51	0	14	0
52	0		0
53	0		0
54	11		0
Total	610066	113557	2096809

* Lower limit for UK data, nearest cm. for Belgium.

Table 4.3.8. Sole in the Celtic Sea (Divisions VIIf and VIIg) Tuning Data.

Belgium Beam Trawl

Year	Effort	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12	Catch, age 13	Catch, age 14
1971	11.06	111	77	384	179	124	154	218	108	32	107	76	21	40
1972	8.44	132	220	76	163	80	52	57	76	39	23	14	38	14
1973	17.39	179	926	368	150	173	58	54	57	108	32	23	21	45
1974	18.83	102	287	565	270	136	156	64	79	90	75	38	39	37
1975	16.38	69	167	195	370	176	64	59	39	33	29	37	18	23
1976	28.07	199	533	357	391	357	167	84	125	40	17	21	51	35
1977	24.11	220	307	244	190	170	283	84	20	35	39	36	18	52
1978	18.09	173	403	185	84	86	54	108	38	11	21	61	8	9
1979	18.90	222	379	506	141	104	133	84	103	35	12	16	4	6
1980	29.02	438	647	583	389	119	45	63	66	92	22	25	16	10
1981	35.39	429	481	565	286	268	107	86	67	86	74	33	13	13
1982	28.77	245	594	221	334	200	148	66	80	54	19	41	16	25
1983	34.95	363	605	409	159	196	127	108	29	44	32	15	12	12
1984	33.48	372	467	334	300	102	153	59	26	26	16	24	19	18
1985	40.49	52	909	471	372	208	75	104	46	68	15	29	16	10
1986	52.46	377	900	823	359	230	140	49	58	65	29	50	6	9
1987	37.23	247	664	438	344	191	119	47	29	20	4	14	2	16
1988	42.92	362	293	603	250	197	77	51	36	26	19	19	13	16
1989	53.58	244	680	428	471	179	145	62	13	24	10	19	3	17
1990	40.27	231	742	663	181	240	70	59	17	26	12	2	4	12
1991	18.05	1028	380	225	131	29	26	9	7	13	8	4	1	2
1992	25.48	327	1062	376	210	98	14	14	7	9	5	1	1	2
1993	28.13	296	615	629	161	81	75	38	36	19	4	2	1	1
1994	34.52	205	524	523	530	176	71	20	15	16	11	6	5	7

Table 4.3.8. (Continued) Sole in the Celtic Sea (Divisions VIIf and VIIg) Tuning Data.

UK (E & W) VIIf Beam Trawl [1]

Year	Effort	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12	Catch, age 13	Catch, age 14
1987	38.76	52	199	251	157	53	61	37	22	8	12	16	13	4
1988	25.62	59	73	97	101	139	23	11	17	28	13	6	25	3
1989	20.26	96	163	43	34	15	11	6	5	1	2	1	1	1
1990	30.77	9	84	231	101	96	32	28	17	11	5	1	2	3
1991	40.81	76	122	168	159	55	62	23	17	11	14	3	5	5
1992	35.78	48	216	94	75	61	19	23	12	13	5	2	1	1
1993	39.64	25	77	190	73	52	37	11	25	10	6	5	2	3
1994	36.99	15	86	62	111	34	28	20	11	13	9	7	4	3

[1] Revised

E & W Corystes Survey (VIIf+g)

Year	Effort	Catch, age 0	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10
1988	74.120	22	60	242	36	14	4	0	0	0	0	6
1989	91.909	132	204	304	162	18	14	6	4	2	2	4
1990	69.858	21	269	219	35	11	3	5	2	0	0	1
1991	123.410	40	297	638	83	21	18	5	0	3	2	1
1992	125.078	5	493	325	174	37	23	12	1	2	1	5
1993	127.672	6	207	436	52	30	2	3	2	1	1	2
1994	120.816	1	424	430	133	23	11	9	0	0	3	3

Only ages 1 -2 and 3 taken for assessment

Table 4.3.9

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Lowestoft VPA Version 3.1

   7-Sep-95  17:17:16

Extended Survivors Analysis

Sole, Celtic Sea (run: XS1/002)

CPUE data from file /users/fish/ifad/ifapwork/wgssds/sol_celt/FLEET.002

Catch data for  24 years. 1971 to 1994. Ages  1 to  10.

     Fleet,           First, Last, First, Last, Alpha,  Beta
                       year, year,  age ,  age
FLT10: Belgium Beam ,  1971, 1994,   2,     9,   .000,  1.000
FLT11: UK(E+W) VIIf ,  1987, 1994,   2,     9,   .000,  1.000
FLT12: UK(E+W) VIIf ,  1988, 1994,   1,     3,   .750,   .850


Time series weights :

     Tapered time weighting applied
     Power =    3 over  20 years


Catchability analysis :

     Catchability dependent on stock size for ages <    4

        Regression type = C
        Minimum of    5 points used for regression
        Survivor estimates shrunk to the population mean for ages <  4


     Catchability independent of age for ages >=    7


Terminal population estimation :

     Survivor estimates shrunk towards the mean F
     of the final    5 years or the    5 oldest ages.

     S.E. of the mean to which the estimates  are shrunk =     .500

     Minimum standard error for population
     estimates derived from each fleet =     .300

     Prior weighting not applied


Tuning converged after   31 iterations
```

Table 4.3.9 (cont'd.)

Log catchability residuals.

Fleet : FLT10: Belgium Beam

Age	1971	1972	1973	1974
1	No data for this fleet at this age			
2	99.99	99.99	99.99	99.99
3	99.99	99.99	99.99	99.99
4	99.99	99.99	99.99	99.99
5	99.99	99.99	99.99	99.99
6	99.99	99.99	99.99	99.99
7	99.99	99.99	99.99	99.99
8	99.99	99.99	99.99	99.99
9	99.99	99.99	99.99	99.99

Age	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	No data for this fleet at this age									
2	-.40	.35	.00	.15	.18	.95	.31	-.02	.21	-.08
3	-.34	.37	.18	.09	.08	.05	.20	.11	-.03	-.21
4	-.29	-.01	-.05	.11	.44	.28	-.08	-.16	-.26	-.35
5	.11	.28	-.08	-.50	.19	.24	-.12	.05	-.26	-.01
6	.30	-.08	.07	-.25	-.04	-.01	.22	.18	-.22	-.18
7	.52	.21	.33	-.39	.58	-.97	.24	.45	.12	.17
8	-.24	.84	.08	.02	.31	-.20	-.25	.49	.61	-.09
9	.18	.35	.14	-.10	.27	.01	.06	.29	-.01	-.09

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	No data for this fleet at this age									
2	-1.91	-.35	.18	-.16	-.50	-.20	1.32	.53	.26	-.22
3	-.07	-.01	-.20	-.55	-.46	.23	.35	.35	.36	-.12
4	-.14	-.10	-.01	-.21	-.14	.18	.14	.23	-.02	.31
5	.10	-.06	-.01	-.06	-.13	-.01	.07	.29	-.21	.15
6	-.01	.04	.32	-.06	.05	.15	-.37	.03	-.21	.20
7	-.15	-.03	.62	-.04	.18	.17	-.56	-.92	.36	.09
8	.15	-.37	-.23	.53	.13	.31	-.44	-1.12	.46	-.55
9	-.03	-.10	.04	-.07	-.31	-.17	-.32	-.48	.22	.00

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	4	5	6	7	8	9
Mean Log q	-4.8959	-4.9189	-4.9390	-5.0240	-5.0240	-5.0240
S.E(Log q)	.2085	.1610	.1985	.4484	.5116	.2281

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	.55	1.063	7.17	.35	20	.39	-6.15
3	.87	.427	5.52	.50	20	.27	-5.11

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
4	1.12	-.442	4.55	.57	20	.24	-4.90
5	.89	.673	5.16	.80	20	.15	-4.92
6	.77	1.523	5.33	.81	20	.14	-4.94
7	.73	.890	5.31	.52	20	.33	-5.02
8	1.09	-.217	5.03	.36	20	.58	-5.08
9	.79	3.263	5.10	.96	20	.12	-5.11

Table 4.3.9 (cont'd.)

Fleet : FLT11: UK(E+W) VIIf

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	No data for this fleet at this age									
2	99.99	99.99	.57	.53	1.53	-1.18	-.11	.27	-.56	-.91
3	99.99	99.99	.15	.17	.68	-.09	-.01	.02	-.46	-.40
4	99.99	99.99	.66	-.25	-.19	.67	.30	-.22	-.29	-.62
5	99.99	99.99	.16	.53	-.80	.66	.44	-.10	-.36	-.49
6	99.99	99.99	-.16	.95	-.62	.35	.29	.06	-.15	-.67
7	99.99	99.99	.63	-.02	-.71	.37	.20	-.24	.03	-.20
8	99.99	99.99	.20	.22	-.52	.54	.39	-.25	-.41	.09
9	99.99	99.99	.43	.41	.42	.82	.46	.43	.22	.33

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	4	5	6	7	8	9
Mean Log q	-6.1689	-5.9066	-5.7785	-5.7357	-5.7357	-5.7357
S.E(Log q)	.4756	.5305	.5307	.4050	.3898	.5019

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	.97	.023	8.15	.12	8	.94	-8.14
3	.78	.552	7.02	.53	8	.30	-6.70

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
4	1.09	-.121	6.02	.23	8	.56	-6.17
5	-6.71	-2.333	16.01	.02	8	2.76	-5.91
6	.66	.666	6.04	.41	8	.37	-5.78
7	1.16	-.170	5.71	.17	8	.51	-5.74
8	1.14	-.209	5.76	.28	8	.48	-5.70
9	1.15	-.753	5.37	.81	8	.20	-5.30

Fleet : FLT12: UK(E+W) VIIf

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	99.99	99.99	99.99	-.95	.16	-.14	.14	.58	-.21	.33
2	99.99	99.99	99.99	-.19	.11	.11	-.13	-.14	.05	.18
3	99.99	99.99	99.99	-.15	.65	-.27	-.03	.04	-.54	.32
4	No data for this fleet at this age									
5	No data for this fleet at this age									
6	No data for this fleet at this age									
7	No data for this fleet at this age									
8	No data for this fleet at this age									
9	No data for this fleet at this age									

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	1.03	-.037	7.54	.26	7	.55	-7.57
2	1.43	-1.717	6.39	.76	7	.18	-7.00
3	.66	.946	8.08	.62	7	.26	-8.04

Table 4.3.9 (cont'd.)

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Belgium Beam ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT11: UK(E+W) VIIf ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT12: UK(E+W) VIIf ,	6679.,	.521,	.000,	.00,	1,	.215,	.000
P shrinkage mean ,	4463.,	.27,,,,				.785,	.000
F shrinkage mean ,	0.,	.50,,,,				.000,	.000

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
4868.,	.24,	.36,	2,	1.478,	.000

Age 2 Catchability dependent on age and year class strength

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Belgium Beam ,	2533.,	.740,	.000,	.00,	1,	.048,	.103
FLT11: UK(E+W) VIIf ,	1272.,	.950,	.000,	.00,	1,	.029,	.196
FLT12: UK(E+W) VIIf ,	3426.,	.260,	.166,	.64,	2,	.391,	.077
P shrinkage mean ,	3598.,	.26,,,,				.417,	.074
F shrinkage mean ,	1805.,	.50,,,,				.115,	.142

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
3111.,	.17,	.13,	6,	.774,	.084

Age 3 Catchability dependent on age and year class strength

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Belgium Beam ,	2155.,	.291,	.132,	.45,	2,	.185,	.312
FLT11: UK(E+W) VIIf ,	1513.,	.354,	.053,	.15,	2,	.125,	.420
FLT12: UK(E+W) VIIf ,	2880.,	.221,	.142,	.64,	3,	.301,	.243
P shrinkage mean ,	2328.,	.27,,,,				.303,	.292
F shrinkage mean ,	1831.,	.50,,,,				.085,	.359

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
2272.,	.13,	.09,	9,	.644,	.296

Table 4.3.9 (cont'd.)

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Belgium Beam ,	1504.,	.212,	.037,	.17,	3,	.398,	.398
FLT11: UK(E+W) VIIf ,	664.,	.295,	.155,	.52,	3,	.194,	.746
FLT12: UK(E+W) VIIf ,	861.,	.222,	.170,	.77,	3,	.269,	.618
F shrinkage mean ,	1217.,	.50,,,,				.139,	.473

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1072.,	.14,	.12,	10,	.882,	.525

Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Belgium Beam ,	1564.,	.179,	.136,	.76,	4,	.498,	.432
FLT11: UK(E+W) VIIf ,	1035.,	.272,	.122,	.45,	4,	.196,	.597
FLT12: UK(E+W) VIIf ,	1221.,	.223,	.055,	.25,	3,	.171,	.526
F shrinkage mean ,	1338.,	.50,,,,				.135,	.490

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1354.,	.13,	.08,	12,	.587,	.496

Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Belgium Beam ,	470.,	.161,	.105,	.65,	5,	.550,	.458
FLT11: UK(E+W) VIIf ,	291.,	.257,	.147,	.57,	5,	.194,	.662
FLT12: UK(E+W) VIIf ,	457.,	.224,	.053,	.23,	3,	.128,	.468
F shrinkage mean ,	425.,	.50,,,,				.128,	.496

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
421.,	.12,	.08,	14,	.619,	.497

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Belgium Beam ,	215.,	.164,	.092,	.56,	6,	.507,	.502
FLT11: UK(E+W) VIIf ,	188.,	.249,	.110,	.44,	6,	.262,	.556
FLT12: UK(E+W) VIIf ,	171.,	.227,	.267,	1.18,	3,	.075,	.598
F shrinkage mean ,	226.,	.50,,,,				.156,	.481

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
206.,	.13,	.06,	16,	.459,	.518

Table 4.3.9 (cont'd.)

Age 8 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1986

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Belgium Beam ,	109.,	.183,	.135,	.74,	7,	.433,	.467
FLT11: UK(E+W) VIIf ,	132.,	.245,	.076,	.31,	7,	.348,	.398
FLT12: UK(E+W) VIIf ,	130.,	.253,	.407,	1.61,	2,	.034,	.404
F shrinkage mean ,	102.,	.50,,,,				.185,	.493

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
116.,	.15,	.07,	17,	.467,	.446

Age 9 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1985

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Belgium Beam ,	39.,	.173,	.129,	.74,	8,	.528,	.714
FLT11: UK(E+W) VIIf ,	44.,	.227,	.133,	.59,	8,	.281,	.662
FLT12: UK(E+W) VIIf ,	38.,	.436,	.000,	.00,	1,	.009,	.726
F shrinkage mean ,	63.,	.50,,,,				.182,	.498

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
44.,	.14,	.09,	18,	.616,	.652

Table 4.3.10

Run title : Sole, Celtic Sea (run: XS1/002)

At 7-Sep-95 17:18:41

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1971,	1972,	1973,	1974,
AGE				
1,	.0000,	.0000,	.0000,	.0000,
2,	.0850,	.0707,	.1043,	.0553,
3,	.1551,	.2572,	.3319,	.1612,
4,	.4158,	.2401,	.3141,	.2271,
5,	.4380,	.3309,	.3456,	.2595,
6,	.3625,	.3802,	.2593,	.3830,
7,	.4843,	.2683,	.2058,	.2569,
8,	.4698,	.3497,	.1942,	.2359,
9,	.4355,	.3147,	.2644,	.2731,
+gp,	.4355,	.3147,	.2644,	.2731,
FBAR 4- 8,	.4341,	.3138,	.2638,	.2725,
FBAR 3- 7,	.3711,	.2953,	.2914,	.2575,

Table 8 Fishing mortality (F) at age YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0418,	.1340,	.0733,	.0832,	.0736,	.2431,	.1471,	.0845,	.1633,	.1207,
3,	.1261,	.3890,	.2497,	.2223,	.1898,	.2823,	.3751,	.2723,	.3644,	.3000,
4,	.1645,	.3300,	.2463,	.2798,	.3340,	.4387,	.3484,	.2573,	.3588,	.3230,
5,	.2391,	.4288,	.2327,	.1475,	.2536,	.4116,	.3255,	.3114,	.3510,	.4440,
6,	.2833,	.2928,	.2671,	.1875,	.1986,	.3164,	.4512,	.3481,	.3566,	.3637,
7,	.3249,	.3599,	.3145,	.1493,	.3412,	.1012,	.4210,	.4178,	.4591,	.4771,
8,	.1522,	.6756,	.2465,	.2246,	.2585,	.2418,	.2585,	.4310,	.7526,	.3676,
9,	.2330,	.4146,	.2566,	.2018,	.2497,	.2973,	.3510,	.3519,	.4103,	.3642,
+gp,	.2330,	.4146,	.2566,	.2018,	.2497,	.2973,	.3510,	.3519,	.4103,	.3642,
FBAR 4- 8,	.2328,	.4174,	.2614,	.1977,	.2772,	.3019,	.3609,	.3531,	.4556,	.3951,
FBAR 3- 7,	.2276,	.3601,	.2621,	.1973,	.2634,	.3100,	.3842,	.3214,	.3780,	.3815,

Run title : Sole, Celtic Sea (run: XS1/002)

At 7-Sep-95 17:18:41

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	FBAR 92-9
AGE											
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0497,	.1055,	.1264,	.1177,	.1416,	.0869,	.2332,	.1409,	.1050,	.0835,	.1098,
3,	.3809,	.4618,	.2765,	.2470,	.3642,	.4216,	.2956,	.3583,	.3493,	.2960,	.3345,
4,	.4424,	.5191,	.5183,	.3939,	.5122,	.6615,	.4045,	.4110,	.3679,	.5246,	.4345,
5,	.5118,	.5436,	.4706,	.5423,	.4725,	.6627,	.4838,	.4774,	.3444,	.4962,	.4393,
6,	.4225,	.6265,	.5446,	.5942,	.5558,	.6523,	.4008,	.4696,	.3938,	.4970,	.4535,
7,	.3145,	.4725,	.8191,	.4692,	.5710,	.6366,	.3579,	.2675,	.5632,	.5177,	.4495,
8,	.4308,	.4353,	.4292,	.7671,	.5552,	.7236,	.4183,	.2468,	.5100,	.4459,	.4009,
9,	.4218,	.5690,	.5564,	.5152,	.4999,	.6778,	.4432,	.5080,	.5657,	.6522,	.5753,
+gp,	.4218,	.5690,	.5564,	.5152,	.4999,	.6778,	.4432,	.5080,	.5657,	.6522,	
FBAR 4- 8,	.4244,	.5194,	.5564,	.5533,	.5334,	.6674,	.4131,	.3744,	.4359,	.4963,	
FBAR 3- 7,	.4144,	.5247,	.5258,	.4493,	.4951,	.6070,	.3885,	.3967,	.4037,	.4663,	

Table 4.3.11

Run title : Sole, Celtic Sea (run: XS1/002)

At 7-Sep-95 17:18:41

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year)					Numbers*10**-3
YEAR,	1971,	1972,	1973,	1974,	
AGE					
1,	9163,	4259,	3414,	3490,	
2,	5003,	8291,	3853,	3089,	
3,	1983,	4158,	6990,	3141,	
4,	4163,	1537,	2909,	4539,	
5,	1862,	2485,	1094,	1923,	
6,	1504,	1087,	1615,	700,	
7,	1476,	947,	672,	1128,	
8,	2148,	823,	655,	495,	
9,	1126,	1215,	525,	488,	
+gp,	3636,	2819,	2906,	2413,	
TOTAL,	32063,	27620,	24635,	21406,	

Table 10 Stock number at age (start of year)							Numbers*10**-3			
YEAR,	1975,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE										
1,	2910,	5164,	4657,	5536,	3586,	5191,	4905,	4958,	6910,	4816,
2,	3158,	2633,	4673,	4214,	5009,	3245,	4697,	4438,	4487,	6252,
3,	2645,	2740,	2084,	3930,	3509,	4211,	2302,	3669,	3691,	3448,
4,	2419,	2110,	1680,	1469,	2847,	2626,	2873,	1432,	2528,	2320,
5,	3273,	1857,	1372,	1188,	1004,	1844,	1532,	1835,	1001,	1598,
6,	1342,	2331,	1094,	984,	928,	705,	1106,	1001,	1216,	638,
7,	432,	915,	1574,	758,	738,	688,	465,	637,	640,	770,
8,	789,	283,	578,	1040,	591,	475,	563,	276,	380,	366,
9,	354,	613,	130,	408,	752,	413,	337,	393,	162,	162,
+gp,	1942,	1438,	1691,	999,	831,	1447,	1366,	1151,	993,	940,
TOTAL,	19264,	20084,	19534,	20526,	19794,	20845,	20147,	19791,	22007,	21310,

Run title : Sole, Celtic Sea (run: XS1/002)

At 7-Sep-95 17:18:41

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year)							Numbers*10**-3						
YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	GMST 71-92	AMST 71-92
AGE													
1,	5836,	3209,	5721,	4382,	3963,	9304,	4393,	4626,	4190,	(5286),	(0,)*	4796,	5018,
2,	4358,	5281,	2904,	5177,	3965,	3586,	8419,	3975,	4186,	3791,	(4868,)**	4375,	4578,
3,	5014,	3752,	4300,	2315,	4164,	3114,	2974,	6033,	3124,	3410,	3111,	3464,	3644,
4,	2311,	3100,	2139,	2951,	1637,	2618,	1848,	2003,	3815,	1993,	2272,	2344,	2457,
5,	1520,	1344,	1669,	1153,	1801,	887,	1222,	1116,	1201,	2389,	1072,	1494,	1572,
6,	927,	824,	706,	943,	606,	1016,	414,	682,	627,	770,	1354,	948,	1017,
7,	401,	550,	399,	371,	471,	315,	479,	251,	386,	382,	421,	614,	685,
8,	433,	265,	310,	159,	210,	241,	151,	303,	174,	199,	206,	423,	524,
9,	229,	254,	155,	183,	67,	109,	106,	90,	214,	94,	116,	276,	376,
+gp,	752,	805,	456,	725,	282,	280,	462,	244,	266,	351,	210,		
TOTAL,	21781,	19385,	18760,	18359,	17166,	21470,	20468,	19322,	18182,	18666,	13629,		

*Replaced by GM = 4796

**Replaced by 4417

Table 4.3.12

Run title : Sole, Celtic Sea (run: XS1/002)

At 7-Sep-95 17:18:41

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 4- 8,	FBAR 3- 7,
1971,	9163,	7359,	5220,	1861,	.3565,	.4341,	.3711,
1972,	4259,	6458,	4524,	1278,	.2825,	.3138,	.2953,
1973,	3414,	5606,	4322,	1391,	.3218,	.2638,	.2914,
1974,	3490,	5726,	4540,	1105,	.2434,	.2725,	.2575,
1975,	2910,	5087,	4050,	919,	.2269,	.2328,	.2276,
1976,	5164,	4802,	3474,	1350,	.3887,	.4174,	.3601,
1977,	4657,	5097,	3578,	961,	.2686,	.2614,	.2621,
1978,	5536,	4776,	3468,	780,	.2249,	.1977,	.1973,
1979,	3586,	4768,	3472,	954,	.2748,	.2772,	.2634,
1980,	5191,	5150,	3801,	1314,	.3457,	.3019,	.3100,
1981,	4905,	4578,	3125,	1212,	.3878,	.3609,	.3842,
1982,	4958,	4857,	3416,	1128,	.3302,	.3531,	.3214,
1983,	6910,	4928,	3243,	1373,	.4233,	.4556,	.3780,
1984,	4816,	5192,	3464,	1266,	.3654,	.3951,	.3815,
1985,	5836,	4843,	3240,	1328,	.4099,	.4244,	.4144,
1986,	3209,	4697,	3124,	1600,	.5122,	.5194,	.5247,
1987,	5721,	3833,	2493,	1222,	.4902,	.5564,	.5258,
1988,	4382,	3971,	2496,	1146,	.4592,	.5533,	.4493,
1989,	3963,	3262,	2048,	992,	.4843,	.5334,	.4951,
1990,	9304,	3922,	2131,	1189,	.5578,	.6674,	.6070,
1991,	4393,	3651,	1972,	1107,	.5615,	.4131,	.3885,
1992,	4626,	3957,	2647,	981,	.3705,	.3744,	.3967,
1993,	4190,	4013,	2577,	928,	.3600,	.4359,	.4037,
1994,	(5286,)[1]	3582,	2227,	1016,	.4563,	.4963,	.4663,
Arith. Mean	4995,	4755,	3277,	1183,	.3793,	.3963,	.3739,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),			

[1] Replaced by GM = 4796

Table 4.3.13

Sole in the Celtic Sea (Fishing Areas VIIf and VIIg)

Prediction with management option table: Input data

Year: 1995								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	4796.000	0.1000	0.0000	0.3300	0.2500	0.090	0.0000	0.100
2	4417.000	0.1000	0.0000	0.3300	0.2500	0.125	0.1251	0.161
3	3111.000	0.1000	1.0000	0.3300	0.2500	0.172	0.3812	0.199
4	2272.000	0.1000	1.0000	0.3300	0.2500	0.253	0.4951	0.265
5	1072.000	0.1000	1.0000	0.3300	0.2500	0.370	0.5006	0.334
6	1354.000	0.1000	1.0000	0.3300	0.2500	0.466	0.5168	0.393
7	421.000	0.1000	1.0000	0.3300	0.2500	0.588	0.5122	0.463
8	206.000	0.1000	1.0000	0.3300	0.2500	0.643	0.4568	0.494
9	116.000	0.1000	1.0000	0.3300	0.2500	0.591	0.6556	0.482
10+	210.000	0.1000	1.0000	0.3300	0.2500	0.795	0.6556	0.619
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1996								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	4796.000	0.1000	0.0000	0.3300	0.2500	0.090	0.0000	0.100
2	.	0.1000	0.0000	0.3300	0.2500	0.125	0.1251	0.161
3	.	0.1000	1.0000	0.3300	0.2500	0.172	0.3812	0.199
4	.	0.1000	1.0000	0.3300	0.2500	0.253	0.4951	0.265
5	.	0.1000	1.0000	0.3300	0.2500	0.370	0.5006	0.334
6	.	0.1000	1.0000	0.3300	0.2500	0.466	0.5168	0.393
7	.	0.1000	1.0000	0.3300	0.2500	0.588	0.5122	0.463
8	.	0.1000	1.0000	0.3300	0.2500	0.643	0.4568	0.494
9	.	0.1000	1.0000	0.3300	0.2500	0.591	0.6556	0.482
10+	.	0.1000	1.0000	0.3300	0.2500	0.795	0.6556	0.619
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	4796.000	0.1000	0.0000	0.3300	0.2500	0.090	0.0000	0.100
2	.	0.1000	0.0000	0.3300	0.2500	0.125	0.1251	0.161
3	.	0.1000	1.0000	0.3300	0.2500	0.172	0.3812	0.199
4	.	0.1000	1.0000	0.3300	0.2500	0.253	0.4951	0.265
5	.	0.1000	1.0000	0.3300	0.2500	0.370	0.5006	0.334
6	.	0.1000	1.0000	0.3300	0.2500	0.466	0.5168	0.393
7	.	0.1000	1.0000	0.3300	0.2500	0.588	0.5122	0.463
8	.	0.1000	1.0000	0.3300	0.2500	0.643	0.4568	0.494
9	.	0.1000	1.0000	0.3300	0.2500	0.591	0.6556	0.482
10+	.	0.1000	1.0000	0.3300	0.2500	0.795	0.6556	0.619
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : S7FPRED1
Date and time: 08SEP95:12:31

Table 4.3.14

Sole in the Celtic Sea (Fishing Areas VIIf and VIIg)

Yield per recruit: Summary table

						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	10.508	5365.254	8.603	5162.421	8.391	5034.961
0.1000	0.0496	0.295	132.184	7.564	3167.280	5.659	2964.447	5.422	2836.397
0.2000	0.0993	0.428	174.465	6.234	2231.278	4.330	2028.445	4.080	1906.645
0.3000	0.1489	0.506	190.028	5.459	1718.755	3.554	1515.922	3.298	1401.234
0.4000	0.1985	0.558	195.339	4.943	1398.564	3.038	1195.731	2.777	1087.724
0.5000	0.2482	0.595	196.230	4.571	1181.450	2.667	978.617	2.402	876.572
0.6000	0.2978	0.624	195.121	4.289	1025.730	2.384	822.897	2.117	726.082
0.7000	0.3474	0.646	193.118	4.067	909.364	2.162	706.531	1.893	614.285
0.8000	0.3970	0.665	190.753	3.886	819.628	1.981	616.795	1.711	528.545
0.9000	0.4467	0.680	188.291	3.737	748.676	1.832	545.843	1.560	461.100
1.0000	0.4963	0.693	185.864	3.610	691.418	1.705	488.585	1.433	406.935
1.1000	0.5459	0.704	183.538	3.502	644.415	1.597	441.582	1.324	362.675
1.2000	0.5956	0.713	181.341	3.408	605.263	1.503	402.430	1.229	325.967
1.3000	0.6452	0.722	179.283	3.326	572.236	1.421	369.403	1.147	295.132
1.4000	0.6948	0.729	-177.365	3.253	544.065	1.348	341.232	1.074	268.935
1.5000	0.7445	0.736	175.581	3.189	519.798	1.284	316.965	1.009	246.457
1.6000	0.7941	0.742	173.924	3.130	498.709	1.226	295.876	0.950	226.996
1.7000	0.8437	0.748	172.385	3.078	480.235	1.173	277.402	0.898	210.011
1.8000	0.8933	0.753	170.954	3.030	463.935	1.125	261.102	0.850	195.079
1.9000	0.9430	0.757	169.624	2.986	449.458	1.082	246.624	0.807	181.863
2.0000	0.9926	0.761	168.386	2.946	436.521	1.041	233.688	0.767	170.095
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : S7FYR1
Date and time : 08SEP95:13:09
Computation of ref. F: Simple mean, age 4 - 8
F-0.1 factor : 0.2018
F-max factor : 0.4821
F-0.1 reference F : 0.1002
F-max reference F : 0.2393
Recruitment : Single recruit

Table 4.3.15

Sole in the Celtic Sea (Fishing Areas VIIf and VIIg)

Single option prediction: Detailed tables

Year: 1995 F-factor: 1.0000 Reference F: 0.4963

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0000	0	0	4796	432	0	0	0	0
2	0.1251	495	80	4417	551	0	0	0	0
3	0.3812	941	188	3111	534	3111	534	2676	459
4	0.4951	848	224	2272	575	2272	575	1882	476
5	0.5006	403	135	1072	396	1072	396	886	328
6	0.5168	522	205	1354	631	1354	631	1114	519
7	0.5122	161	75	421	248	421	248	347	204
8	0.4568	72	36	206	132	206	132	173	111
9	0.6556	53	26	116	69	116	69	91	54
10+	0.6556	97	60	210	167	210	167	165	131
Total		3593	1027	17975	3734	8762	2752	7333	2282
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1996 F-factor: 1.0000 Reference F: 0.4963

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0000	0	0	4796	432	0	0	0	0
2	0.1251	486	78	4340	541	0	0	0	0
3	0.3812	1067	213	3527	606	3527	606	3033	521
4	0.4951	717	190	1923	486	1923	486	1593	403
5	0.5006	472	158	1253	463	1253	463	1036	383
6	0.5168	227	89	588	274	588	274	484	225
7	0.5122	280	130	731	430	731	430	602	354
8	0.4568	80	40	228	147	228	147	191	123
9	0.6556	54	26	118	70	118	70	93	55
10+	0.6556	70	44	153	122	153	122	120	96
Total		3454	966	17656	3570	8521	2597	7151	2159
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1997 F-factor: 1.0000 Reference F: 0.4963

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0000	0	0	4796	432	0	0	0	0
2	0.1251	486	78	4340	541	0	0	0	0
3	0.3812	1048	209	3465	595	3465	595	2980	512
4	0.4951	813	215	2180	551	2180	551	1805	457
5	0.5006	399	133	1060	392	1060	392	877	324
6	0.5168	265	104	687	320	687	320	565	263
7	0.5122	122	56	317	187	317	187	261	154
8	0.4568	139	69	396	255	396	255	332	214
9	0.6556	60	29	131	77	131	77	103	61
10+	0.6556	59	36	127	101	127	101	100	80
Total		3391	930	17499	3451	8364	2479	7024	2064
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : S7FPRED2
Date and time : 08SEP95:13:00
Computation of ref. F: Simple mean, age 4 - 8
Prediction basis : F factors

Table 4.3.16

Sole in the Celtic Sea (Fishing Areas VIIf and VIIg)

Prediction with management option table

Year: 1995					Year: 1996					Year: 1997	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.4963	3734	2282	1027	0.0000	0.0000	3570	2533	0	4681	3617
.	.	.	.	.	0.1000	0.0496	.	2493	117	4531	3415
.	.	.	.	.	0.2000	0.0993	.	2453	229	4387	3225
.	.	.	.	.	0.3000	0.1489	.	2414	336	4250	3046
.	.	.	.	.	0.4000	0.1985	.	2376	439	4120	2879
.	.	.	.	.	0.5000	0.2482	.	2339	537	3995	2721
.	.	.	.	.	0.6000	0.2978	.	2302	630	3876	2573
.	.	.	.	.	0.7000	0.3474	.	2265	720	3762	2434
.	.	.	.	.	0.8000	0.3970	.	2229	806	3654	2303
.	.	.	.	.	0.9000	0.4467	.	2194	888	3550	2180
.	.	.	.	.	1.0000	0.4963	.	2159	966	3451	2064
.	.	.	.	.	1.1000	0.5459	.	2125	1041	3357	1954
.	.	.	.	.	1.2000	0.5956	.	2092	1113	3266	1852
.	.	.	.	.	1.3000	0.6452	.	2059	1182	3180	1755
.	.	.	.	.	1.4000	0.6948	.	2026	1248	3097	1664
.	.	.	.	.	1.5000	0.7445	.	1994	1311	3019	1578
.	.	.	.	.	1.6000	0.7941	.	1963	1371	2943	1497
.	.	.	.	.	1.7000	0.8437	.	1932	1429	2871	14
.	.	.	.	.	1.8000	0.8933	.	1901	1485	2802	1349
.	.	.	.	.	1.9000	0.9430	.	1871	1538	2736	1281
.	.	.	.	.	2.0000	0.9926	.	1842	1589	2673	1217
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : S7FPRED1
Date and time : 08SEP95:12:31
Computation of ref. F: Simple mean, age 4 - 8
Basis for 1995 : F factors

Table 4.3.17 Celtic Sea sole. Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class	1991	1992	1993	1994	1995
Stock No. (thousands) of one-year-olds	4626	4190	4796	4796	4796
Source	VPA	VPA	GM	GM	GM
Status Quo F:					
% in 1995 catch	21.8	18.3	7.8	0.0	-
% in 1996 catch	16.3	19.6	22.0	8.1	0.0
% in 1995 SSB	20.9	20.1	0.0	0.0	-
% in 1996 SSB	17.7	18.7	24.1	0.0	0.0
% in 1997 SSB	12.7	15.7	22.1	24.8	0.0

GM = geometric mean recruitment

VIIf + g sole : Year-class % contribution to a) 1996 landings and b) 1997 SSB

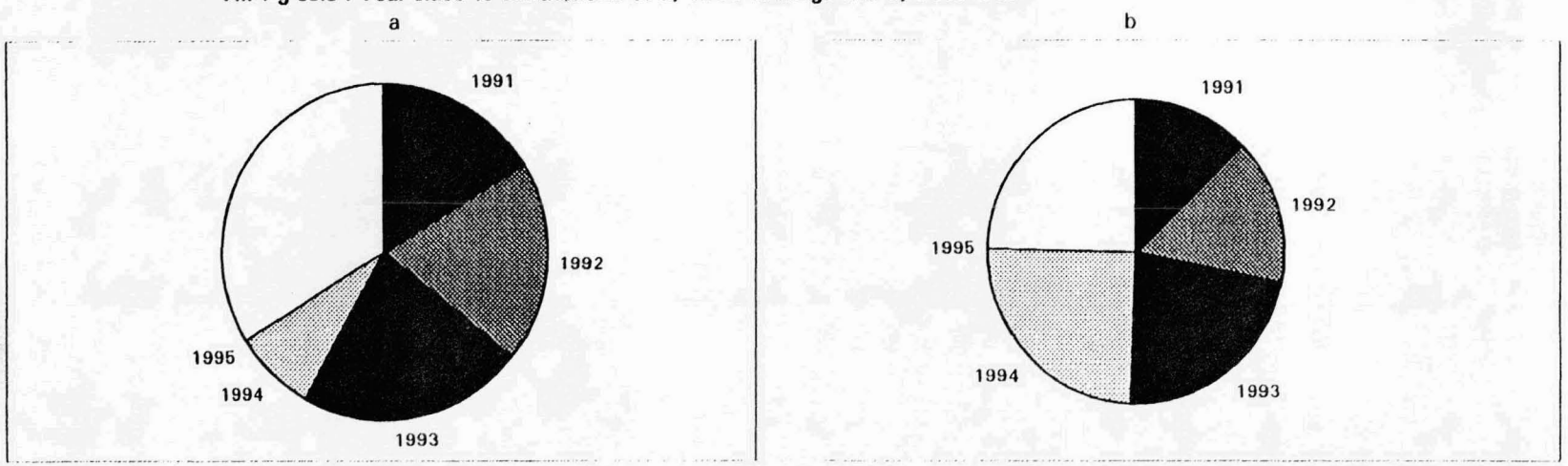


Table 4.3.18 Celtic Sea Sole (VIIf+g) Input data for linear sensetivity analysis

Name	Value	Uncertainty (CV)	Name	Value	Uncertainty (CV)
Population at age in 1995			Fishing mortality pattern		
N1	4796	0.30	sH1	0.000	0.000
N2	4417	0.36	sH2	0.125	0.600
N3	3111	0.17	sH3	0.381	0.200
N4	2272	0.13	sH4	0.495	0.100
N5	1072	0.14	sH5	0.501	0.180
N6	1354	0.13	sH6	0.517	0.130
N7	421	0.12	sH7	0.512	0.220
N8	206	0.13	sH8	0.457	0.210
N9	116	0.15	sH9	0.656	0.130
N10	210	0.14	sH10	0.656	0.130
Weight in the catch at age			Weight in the stock at age		
WH1	0.100	0.000	WS1	0.090	0.000
WH2	0.161	0.070	WS2	0.125	0.160
WH3	0.199	0.020	WS3	0.172	0.190
WH4	0.265	0.040	WS4	0.253	0.090
WH5	0.334	0.060	WS5	0.370	0.100
WH6	0.393	0.060	WS6	0.466	0.070
WH7	0.463	0.020	WS7	0.588	0.240
WH8	0.494	0.030	WS8	0.643	0.150
WH9	0.482	0.050	WS9	0.591	0.170
WH10	0.619	0.070	WS10	0.795	0.160
Natural mortality pattern			Maturity ogive pattern		
M1	0.1	0.1	MT1	0	0
M2	0.1	0.1	MT2	0	0.1
M3	0.1	0.1	MT3	1	0.1
M4	0.1	0.1	MT4	1	0
M5	0.1	0.1	MT5	1	0
M6	0.1	0.1	MT6	1	0
M7	0.1	0.1	MT7	1	0
M8	0.1	0.1	MT8	1	0
M9	0.1	0.1	MT9	1	0
M10	0.1	0.1	MT10	1	0
Effort multiplier in year			Natural mortality multiplier in year		
HF95	1	0.24	K95	1	0.1
HF96	1	0.24	K96	1	0.1
HF97	1	0.24	K97	1	0.1
Recruitment in year					
R96	4796	0.3			
R97	4796	0.3			

Figure 4.3.1. a

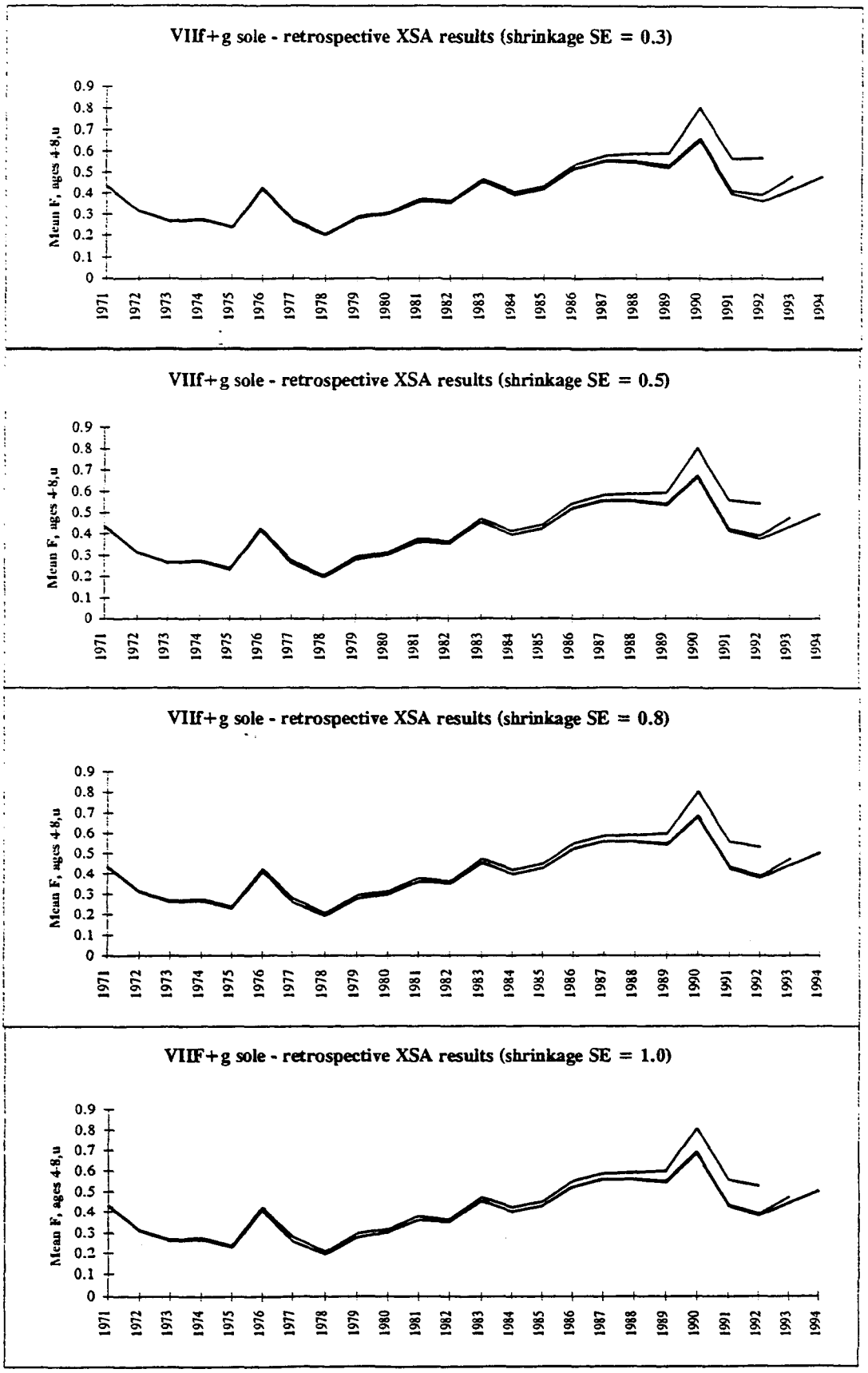

VIIf+g sole - retrospective XSA results (shrinkage SE = 0.3)
VIIf+g sole - retrospective XSA results (shrinkage SE = 0.5)
VIIf+g sole - retrospective XSA results (shrinkage SE = 0.8)
VIIF+g sole - retrospective XSA results (shrinkage SE = 1.0)
Mean F, ages 4-8,u
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994

Figure 4.3.1.b

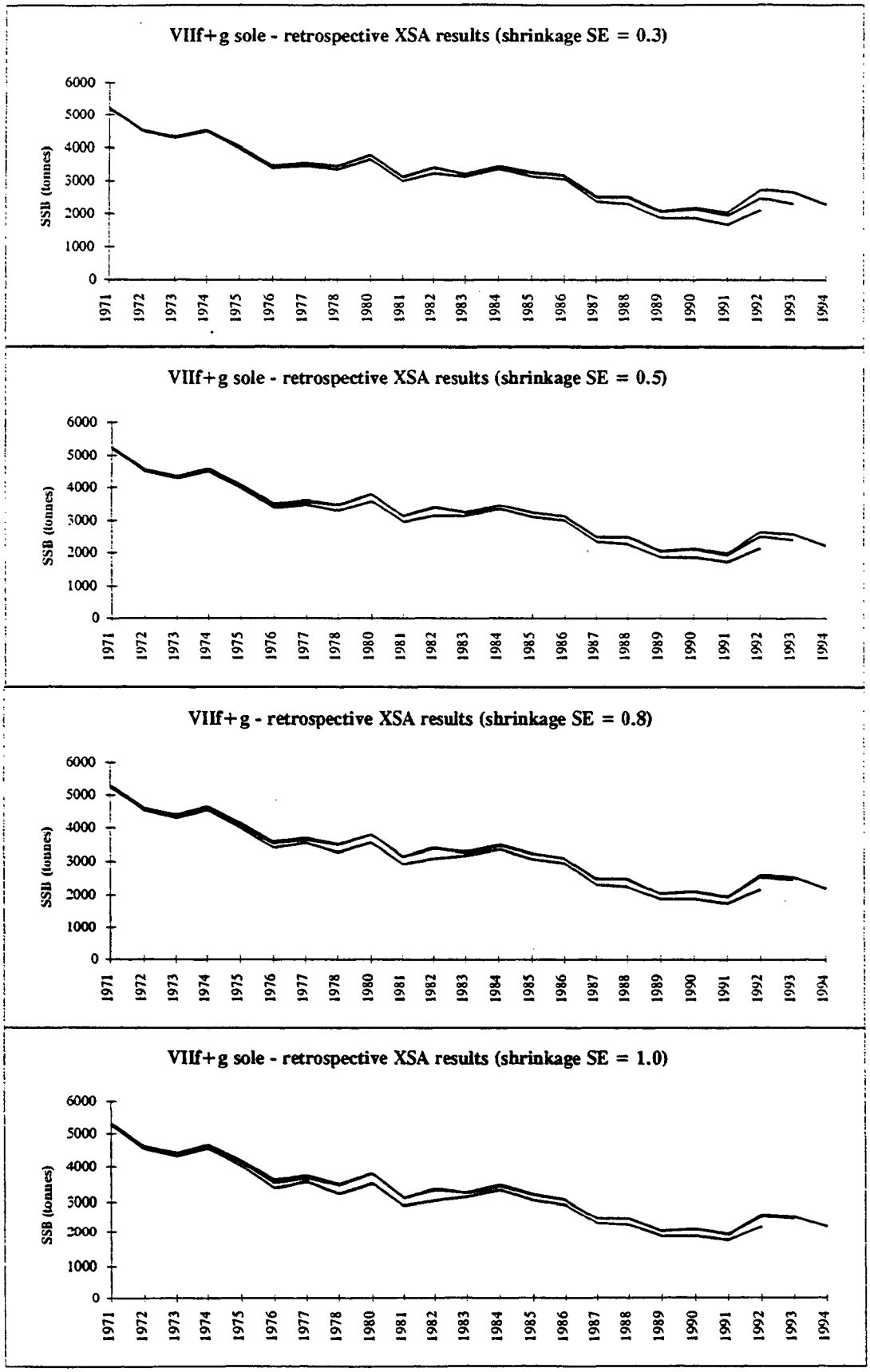
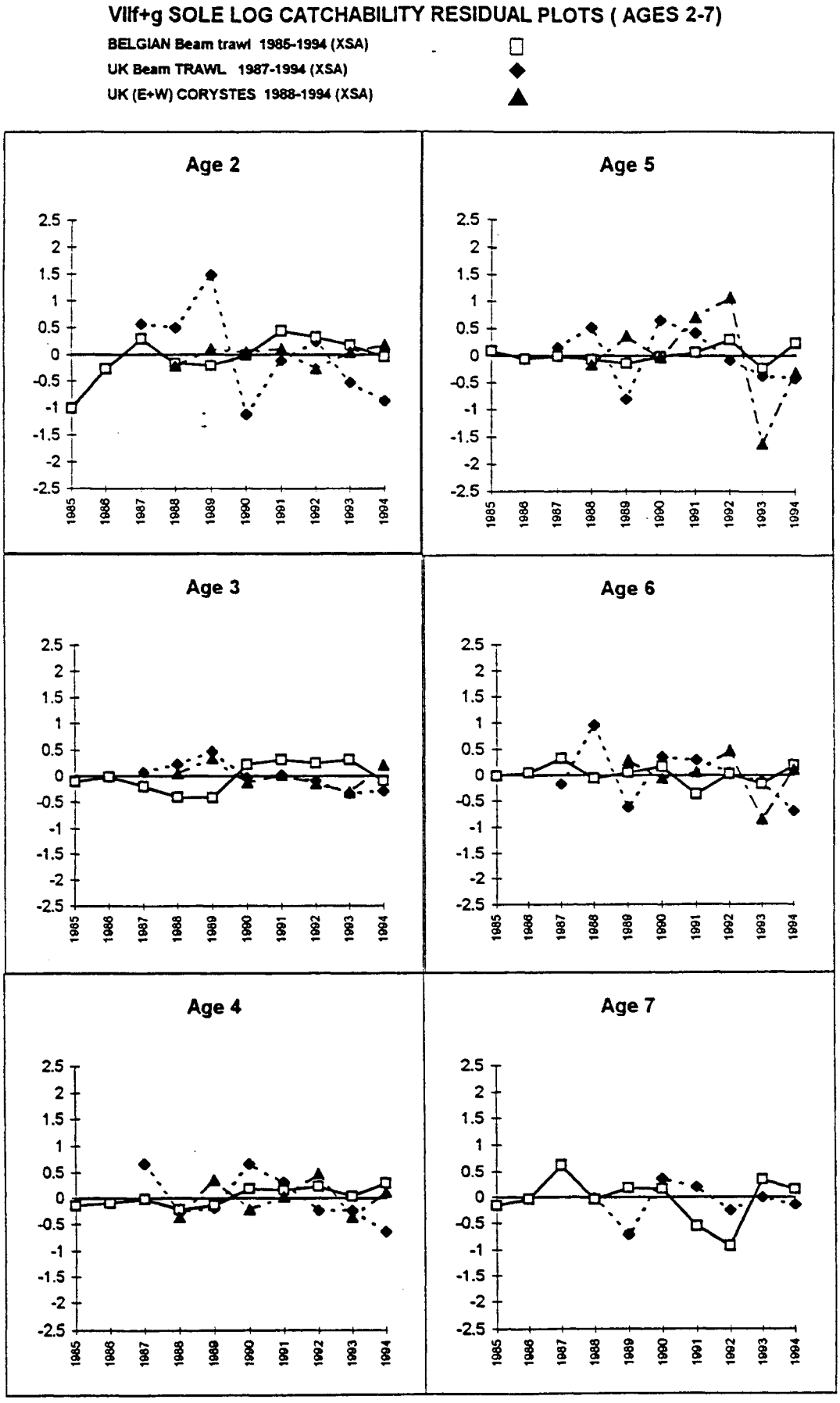

VIIf+g sole - retrospective XSA results (shrinkage SE = 0.3)
VIIf+g sole - retrospective XSA results (shrinkage SE = 0.5)
VIIf+g - retrospective XSA results (shrinkage SE = 0.8)
VIIf+g sole - retrospective XSA results (shrinkage SE = 1.0)
SSB (tonnes)
0
1000
2000
3000
4000
5000
6000
1971
1972
1973
1974
1975
1976
1977
1978
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994

Figure 4.3.2

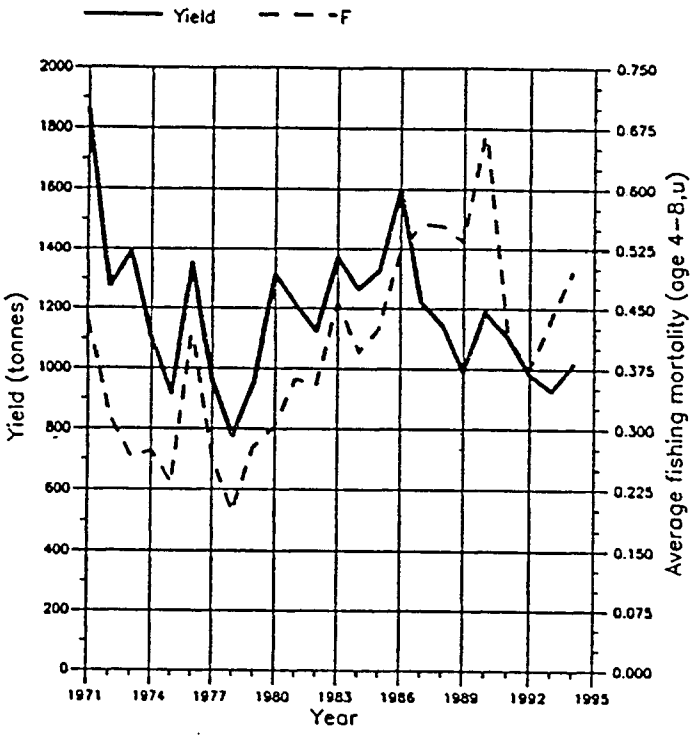

VIIf+g SOLE LOG CATCHABILITY RESIDUAL PLOTS (AGES 2-7)
BELGIAN Beam trawl 1985-1994 (XSA)
UK Beam TRAWL 1987-1994 (XSA)
UK (E+W) CORYSTES 1988-1994 (XSA)
Age 2
Age 5
Age 3
Age 6
Age 4
Age 7
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994

FISH STOCK SUMMARY

Table 4.3.3 **STOCK: Sole in the Celtic Sea (Fishing Areas VIIf and VIIg)**

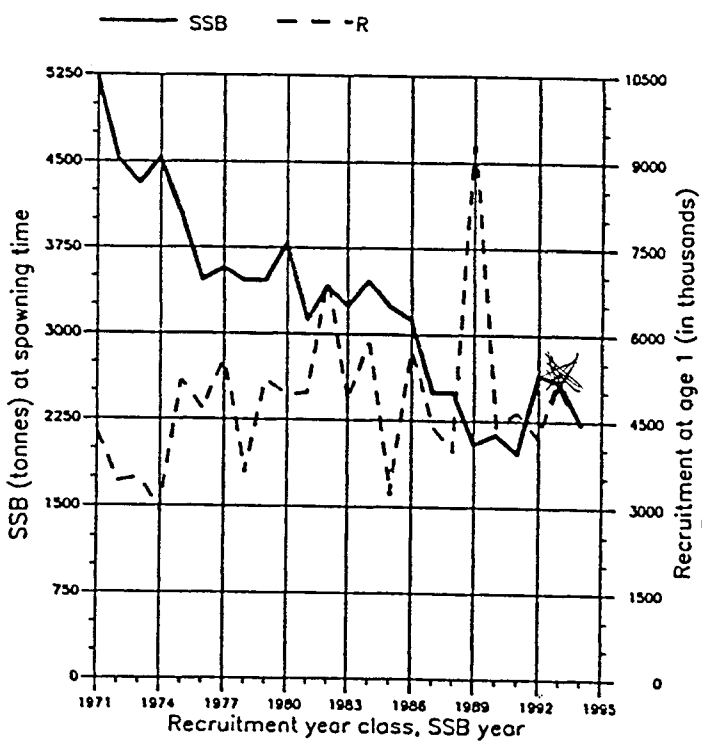
7–9–1995

Trends in yield and fishing mortality (F)



(run: XS1) **A**

Trends in spawning stock biomass (SSB) and recruitment (R)



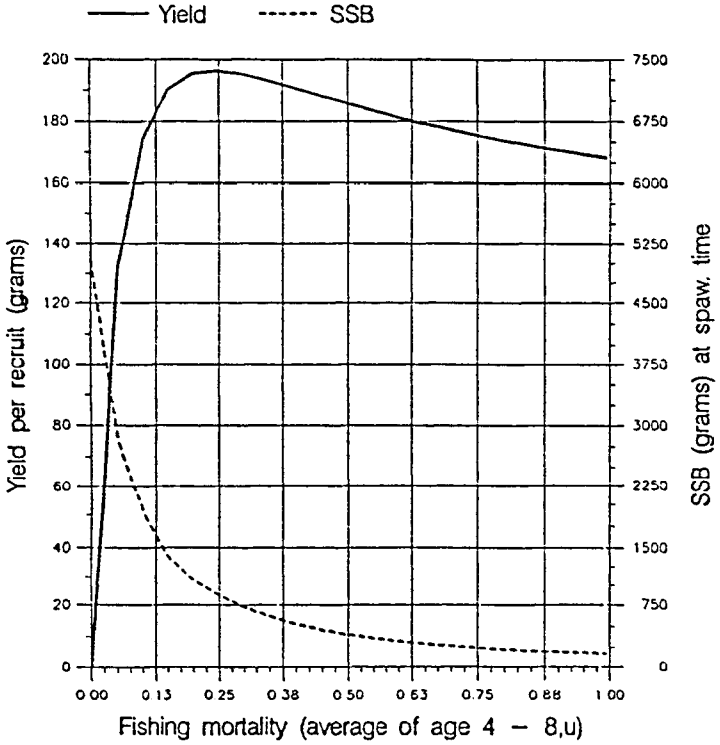
(run: XS1) **B**

Fish Stock Summary

Sole in the Celtic Sea (Fishing Areas VIIf and VIIg)

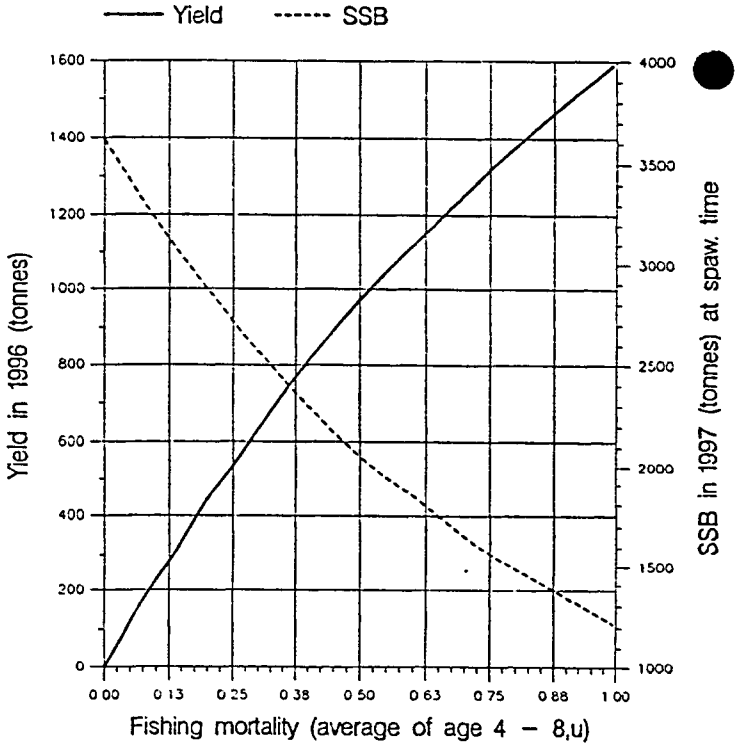
8–9–1995

Long term yield and spawning stock biomass



(run: S7FYR1) **C**

Short term yield and spawning stock biomass



(run: S7FPRED1) **D**

Figure 4.3.4

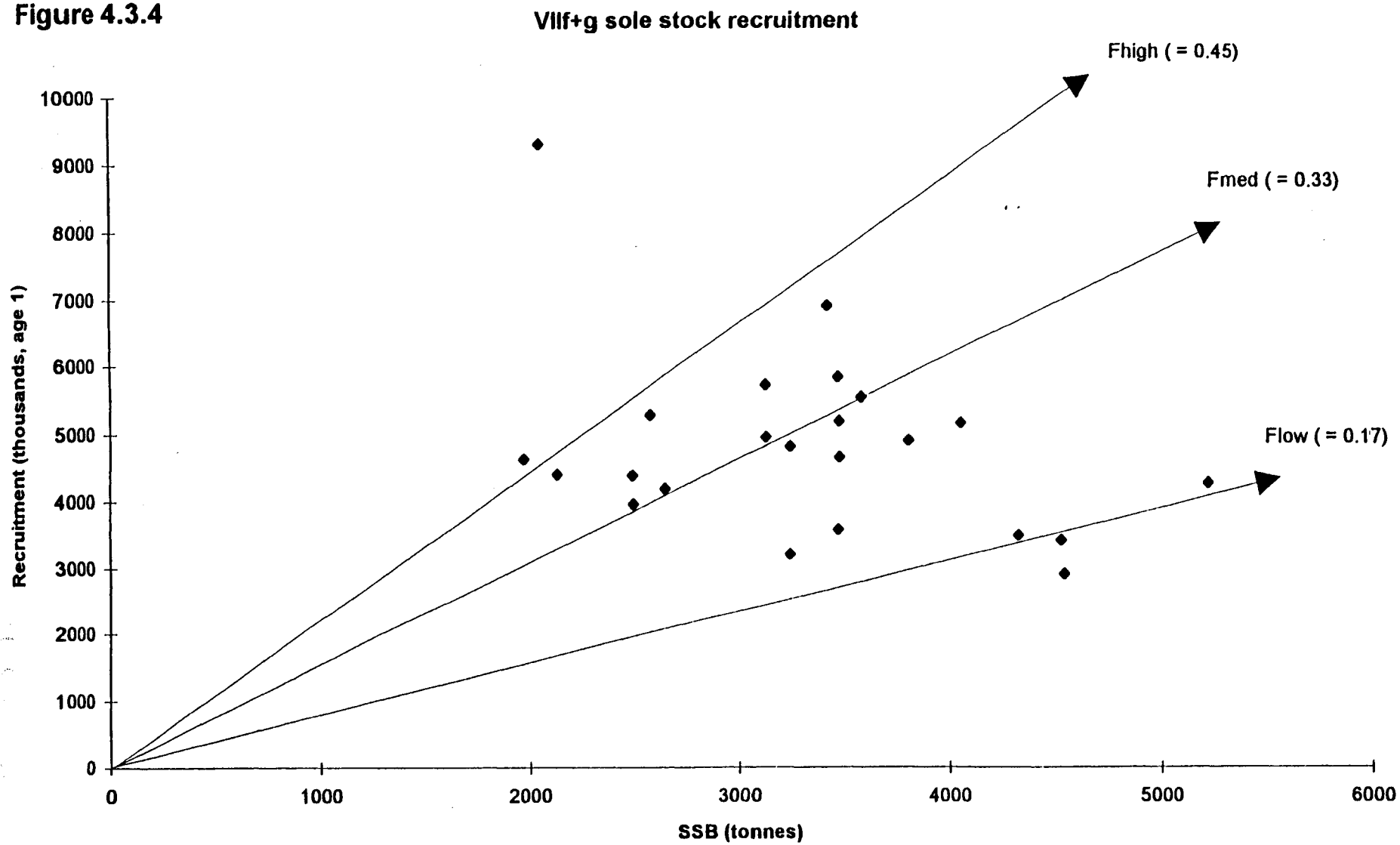

VIIf+g sole stock recruitment
Fhigh (= 0.45)
Fmed (= 0.33)
Flow (= 0.17)
Recruitment (thousands, age 1)
SSB (tonnes)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000

Figure 4.3.5 Celtic Sea Sole. Sensitivity analyses of short term forecast

Linear sensitivity coefficients

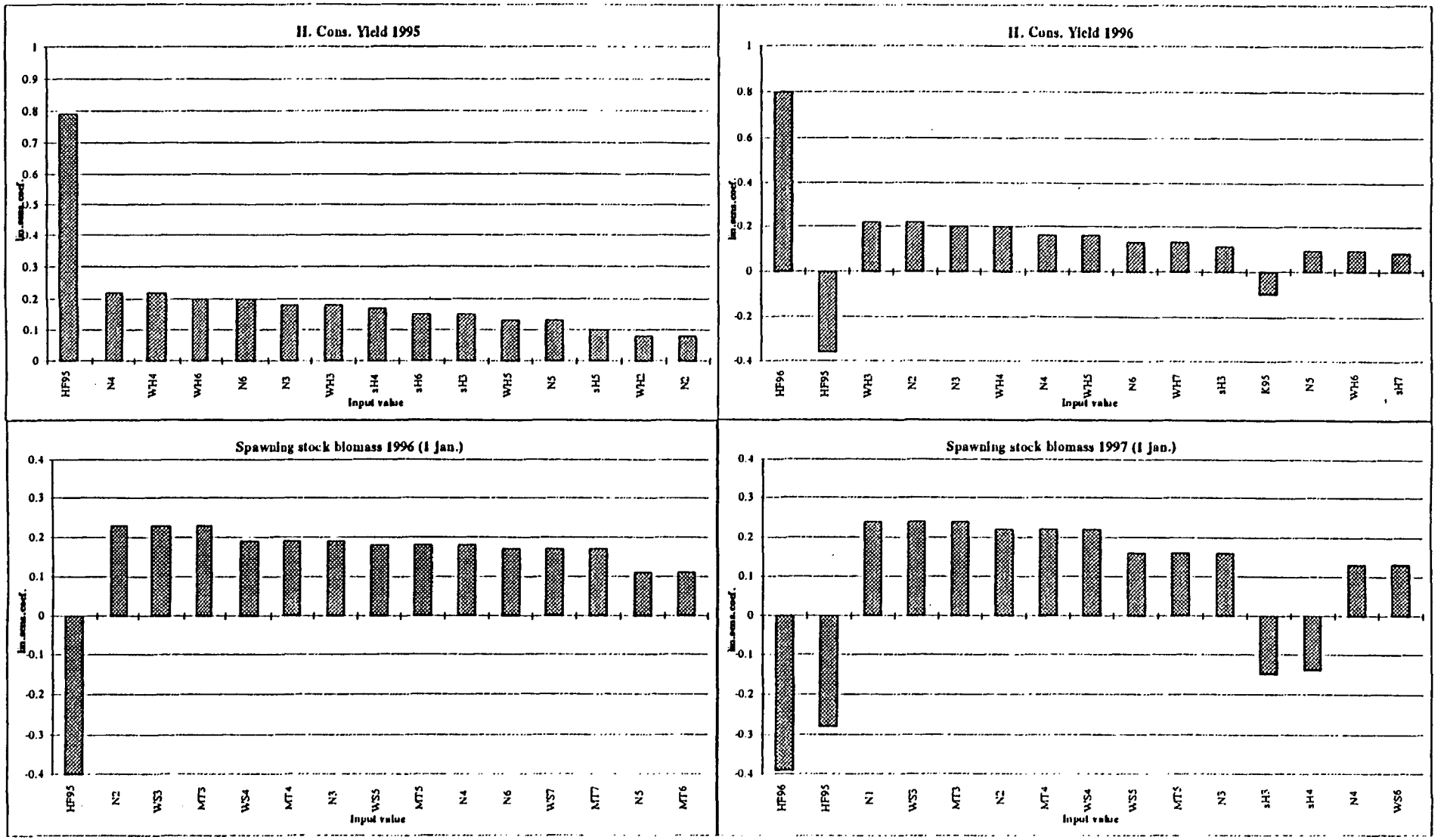


Figure 4.3.6 Celtic Sea Sole. Sensitivity analyses of short term forecast

Proportion of total variance contributed by each input value

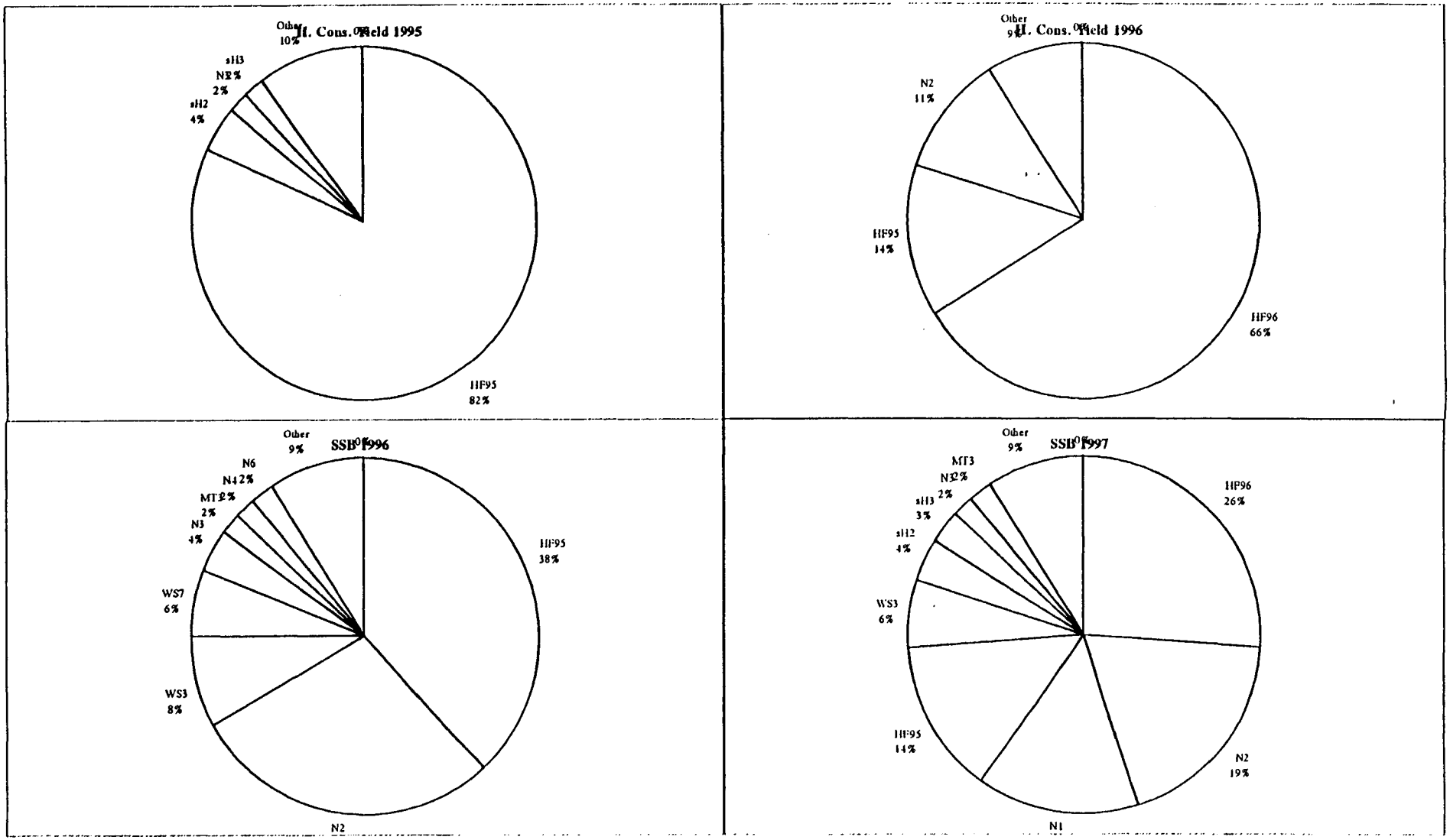
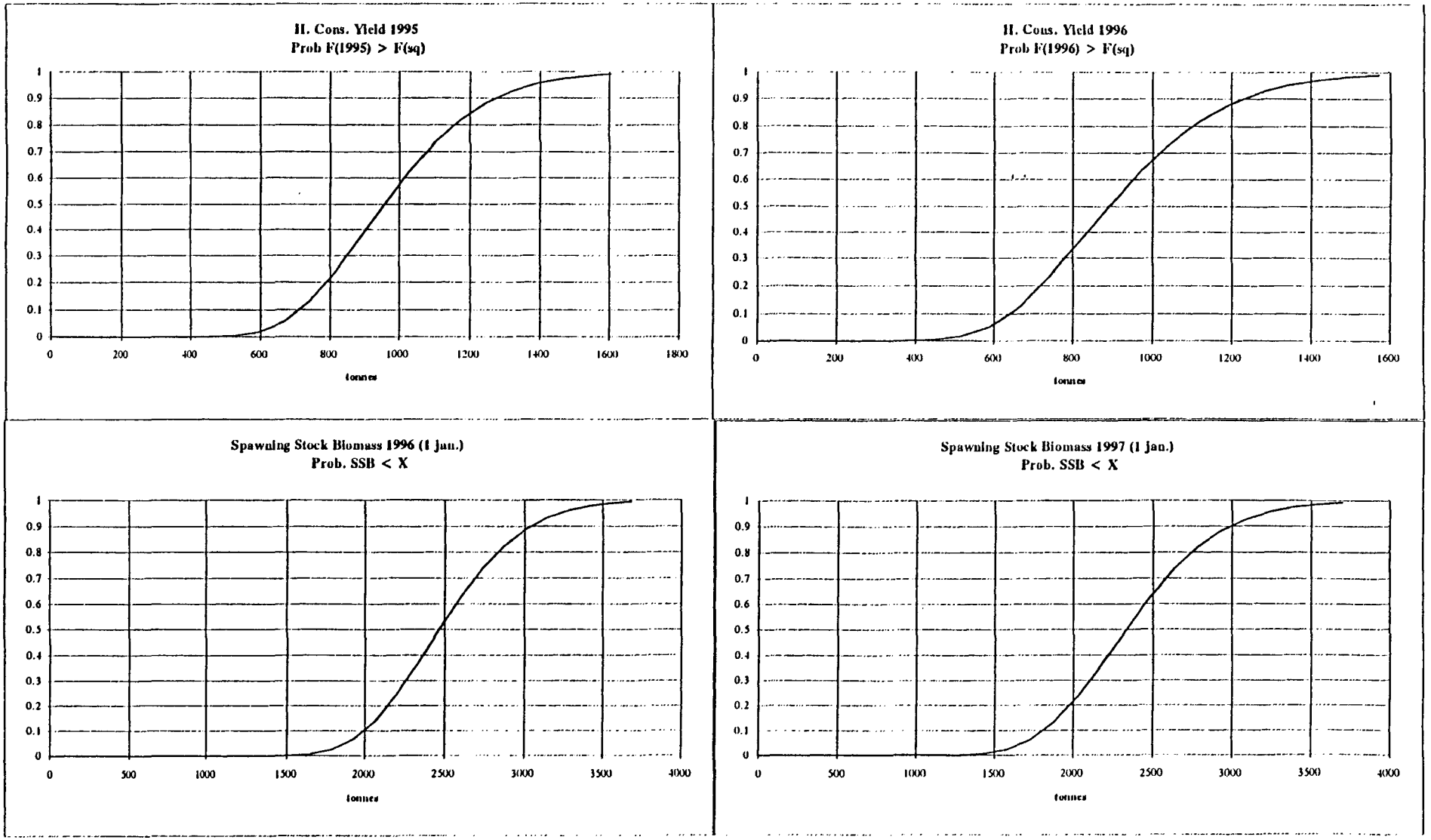


Figure 4.3.7 Celtic Sea Sole. Sensitivity analyses of short term forecast

Cumulative probability distributions



4.4 PLAICE IN THE CELTIC SEA DIVISION VII f and g

4.4.1 Landings trends

National landings data reported to ICES, and Working Group estimates of total landings, are given in Table 4.4.1. The 1993 total landings estimate of 1108 t was modified to 1114 t to reflect an increase in reported landings by France.

The estimated total international landings for 1994 were 1086 t, 22 % below the TAC (1400t) and 15 % below the value predicted at last year's meeting (1280 t). Landings reached a peak of 2100t during 1988-1990 following good recruitments in the mid-1980s, but have since declined.

UK vessels were subject to monthly landings quotas during 1994, and all fleets fishing for plaice were unrestricted during 1994.

There is no information on the level of misreporting on this stock, but it is not thought to be large in comparison with the reported landings.

4.4.2 Commercial catch-effort data and research vessel surveys

Effort and CPUE data were available for the UK(E+W) beam trawl, otter trawl and Belgian beam trawl fleets, and the UK September beam trawl survey (Table 4.4.2).

Both UK commercial data sets show that after peaking in 1988, CPUE then declined to a minimum in 1992-94. Data for the Belgian beam trawlers show a increased CPUE in 1990-1991, and then a decline to the levels of the mid to late 1970s. The survey series, although short, shows a relatively high level of CPUE in 1989-1990, but a much lower level in 1993 and 1994. The provisional 1995 value from the survey (5.72) is 40 % above the 1994 level.

Belgian effort data show an increase of 18% from 1993 to 1994, close to the average level during the early 1980s. The UK(E+W) effort data series show decreases of 7% and 30% for beam trawlers and otter trawlers respectively from 1993 to 1994, with the latter being less than half of the level during the 1980s.

4.4.3 Age and length compositions and mean weights at age

Annual length compositions are given in Table 4.4.3.

The 1993 age compositions were raised to reflect the small increase in landings. Weights at age were unchanged.

1994 quarterly age compositions were available for Belgium and UK only, representing 56% of the total landings. The UK age composition was raised to include the landings by France and Ireland, and combined with the Belgian age composition to give the total international figures. The overall SOP discrepancy was less than 1%.

Using the same procedure as in previous years, total international catch and stock weights at age for 1994 were calculated as the weighted mean of the national weights at age, smoothed using a quadratic fit for 1994 of:

$$Wt = -0.0015+0.1076*(age)-0.0015*(age**2)$$

where catch weights at age are mid-year values (age = 1.5, 2.5 etc), and stock weights at age are January 1 values (age = 1.0, 2.0 etc). Catch weights at age have been scaled to give a SOP of 100%, and the same scaling has been applied to the stock weights at age. Weights at age for this stock are smoothed because sampling levels have in the past been lower than on other stocks, and the resulting data sets have been noisy.

The UK age compositions for the period 1984-1988 have been revised. Age-length samples were sometimes inadequate during this period. New facilities in the UK database system have allowed the sampling data to be re-examined, and new ALKs derived using data from adjacent time periods, where necessary. Weights at age were re-calculated using the quadratic smoothing approach (as above).

Catch numbers and weights at age in the catch and stock are given in Tables 4.4.4 - 4.4.6.

4.4.4 Natural mortality and maturity at age

As in previous assessments, natural mortality was assumed to be the same as that found for Irish Sea plaice (see earlier Irish Sea and Bristol Channel WG reports), a value of 0.12 for all ages and years. The maturity at age ogive is also derived from that estimated for Irish Sea plaice (Table 4.4.12).

Proportions of F and M before spawning were set at 0.2, as last year.

4.4.5 VPA Tuning

See section 1.5.1 for the general approach adopted at the WG. The age range for the analyses was 1-9+, as in previous assessments.

A separable VPA was run in order to screen the catch at age data, using a reference age of 4, and F and S values of 0.9 and 0.75 respectively. The results (in ICES files) show no unusual patterns of residuals, but

occasional high values reflect the rather poor quality of catch at age data for this stock. The residuals for the period 1984-88 are generally lower than those seen last year, having benefited from the revisions to the data set.

Catch numbers at age and associated effort data for the Belgian beam trawl, UK commercial otter trawl, UK commercial beam trawl and UK beam trawl survey fleets were available for use in VPA tuning (Table 4.4.7). The UK commercial fleet tuning data have also been revised to give otter trawl and beam trawl fleet data sets based on length samples from each of those gears used with an all-gears ALK. These data could only be separated for the years after 1988, and there were no retrospective XSA runs this year, due to the short time series of the revised tuning fleets' data.

Laurec-Shepherd tuning runs were carried out to screen the tuning data and check for catchability trends. The oldest age was set to 0.75 of the mean F of the three preceding ages (as in previous years), and full tuning year ranges were used with tricubic weighting over 20 years. Although catchability was more variable in the less well-sampled ages, there were no consistent trends in any of the data sets (Figures available in ICES files).

A series of XSA runs was carried out to examine the effects of modifying the input parameters. Changing the number of years and ages for F shrinkage had little effect on the results, but shrinkage over 4 ages was considered preferable, given that the plus group is at age 9. Changing the plus group age merely raised or lowered the overall level of F, but did not affect trends in F. The separable residuals confirmed that age 9 is an appropriate plus group for this stock. As noted last year, a light shrinkage appeared to give a better fit to the data than a strong one, but there was little difference between the results for shrinkage SEs of 0.8 and 1.1. (Results in ICES stock files).

Additional runs were carried out to test the effect of setting q dependent on year class strength for ages 1 and 2; 1 - 3; 1 - 4; or setting q for all ages independent of year class strength. The run treating age 1 as recruits gave marginally better standard errors than those runs with older ages included in this treatment, but the effect on mean F(3-6) was small (results in ICES files). Treating all ages independent of year class strength gave almost identical results to the first run, except at age 1. Since the time series of the UK tuning fleets are relatively short, and the survey standard error is high for age 1, with a consequent low weighting to the estimate of survivors at age 1, this is based almost completely on the shrinkage means. In this case, given that F on age 1 is low and variable, it was considered preferable not to treat any age as recruits in the final XSA run.

The diagnostics from the final XSA run (no age treated as recruits, q plateau at age 7, as last year, and shrinkage of 0.8) are given in Table 4.4.8, and plots of catchability residuals are shown by fleet and age in Figure 4.4.1. Diagnostics and VPA outputs from the other runs are available in ICES files.

Diagnostics indicate that fleet estimates of survivors for ages 2 and older are generally consistent, with none of the fleets giving consistently higher or lower estimates. Compared to the fleets, shrinkage has little effect for ages 3 and older .

4.4.6 VPA results

Fishing mortalities and population numbers from the final XSA run are given in Tables 4.4.9 and 4.4.10 respectively, and summarised in Table 4.4.11 and Figures 4.4.2 A and B.

Fishing mortality in 1994 (mean F3-6) is estimated to have been 0.83, considerably higher than for 1993 (0.57) and at the level of the historic high value in 1990. SSB was at a high level in the late 1980s, following a series of above-average recruitments, but has shown a sharp decline since 1990, to a level which is 70 % of the time-series mean, but still above the lowest recorded level in the late 1970s. All year classes since 1987 have been below average and the 1992 year-classes was the poorest in the series.

4.4.7 Estimating recruiting year-class abundance

The inclusion of the beam trawl survey data in XSA precludes the use of RCT3 for recruit regression analysis for those year-classes within the range of the VPA. The XSA estimates of the 1992 year-class strength (1.9 million 1-year olds) is the lowest in the time series. This represents a strong downward revision from last year's estimate, which was almost entirely based on taper-weighted GM recruitment. The three UK fleets each contribute more than F-shrinkage to this year's estimate, and it was accepted.

The survey contributes little to the estimates of 1-group survivors, due to its high standard error, and the revised UK otter- and beam-trawl fleets are given most weight in the estimate of the 1993 year class survivors, though the associated F values are very low. The resulting estimate is the second highest in the time series, and preliminary information from the 1995 September beam-trawl survey indicates that the strength of the 1993 year class is not above average.

Age 0 data from the survey are sparse and cannot be used to predict incoming recruitment. GM recruitment (5.2 million 1 year-olds) was therefore assumed for the 1993, 1994 and 1995 year-classes in the prediction.

4.4.8 Yield per recruit and catch forecast

The input values for the yield per recruit and catch forecast are given in Table 4.4.12. The F at age values used were calculated as the mean of the VPA values from 1992-1994, scaled to F94. Catch and stock weights at age were the mean of the period 1992-1994. SSB values are calculated for spawning time. Stock numbers at age in 1995 for ages 3 and older were obtained from the VPA, and younger ages were derived from GM recruitment, adjusted by stock number ratios.

Yield and SSB per recruit results are presented in Table 4.4.13 and given in Figure 4.4.2 C. Fmax at 0.3 is 40% of F94.

F94 is above the value of Fmed given by the stock-recruitment plot (0.65 - Figure 4.4.3). The level of recruitment appears to be independent of SSB.

Table 4.4.14 gives the management option table from the catch prediction, and short-term results are shown in Figure 4.4.2 D . Assuming status quo F in 1995 gives a catch of 1115t and a SSB of 1100t. At status quo F in 1996, catch and SSB are predicted to be around 1200t and 1000t respectively. SSB in 1997 is predicted to be 1100t, which remains among the lowest in the time series. The detailed output by age group is given in Table 4.4.15, and the estimated contributions of recent year-classes to the predicted catches and SSBs are given in Table 4.4.16. The assumptions of GM recruitment contribute around 60 % and 80 % to the catch in 1996 and SSB in 1997, respectively.

4.4.9 Comments on the assessment

Successive assessments have indicated a tendency to revise fishing mortality downwards (and SSB up, except where GM assumptions apply strongly), and the F in 1993 has been revised from 0.77 to 0.57 this year.

Sampling levels for this stock have usually been less than satisfactory, as indicated by the assessment diagnostics. Age readings, however, are considered reliable. There is no information on the extent of misreporting of catches. Although there is some inconsistency between annual assessments, and pre-recruit information is still required, stock status is considered reliable.

4.4.10 Management considerations

There has been a general increase in F, except for a temporary decrease in 1992/93, and, combined with poor recruitments, this has resulted in a sharp decline in SSB to a level close to the minimum observed for the stock. SSB will decline around 1000t in 1996 if the current level of fishing mortality is maintained.

Plaice and sole are taken in a mixed fishery and management advice should take this into account.

Figure 4.4.4 gives the short-term forecast results for the two species together.

Table 4.4.1 Celtic Sea PLAICE. Nominal landings (tonnes) in Divisions VIIf+g, 1977-1994, as used by the Working Group.

Year	Belgium	France	Ireland	UK (Engl. & Wales)	Others	Total reported	Unallocated	Total as used by WG
1977	214	365	28	150	0	757	0	757
1978	196	527	0	152	0	875	0	875
1979	171	467	49	176	0	863	0	863
1980	372	706	61	227	7	1,373	0	1,373
1981	365	697	64	251	0	1,377	0	1,377
1982	341	568	198	196	0	1,303	0	1,303
1983	314	532	48	279	0	1,173	-27	1,146
1984	283	558	72	366	0	1,279	-69	1,210
1985	357	493	91	466	0	1,407	345	1,752
1986	544	598	59	324	21	1,546	145	1,691
1987	576	708	122	495	0	1,901	0	1,901
1988	635	687	164	630	0	2,116	0	2,116
1989	835	649	195	472	0	2,151	0	2,151
1990	777	642	167	496	0	2,082	0	2,082
1991	479	533	94	395	0	1,501	0	1,501
1992	326	455	106	301	0	1,188	0	1,188
1993	396	342	87	290	0	1,114	0	1,114
1994	357	297	182	250	0	1,086	0	1,086

N.B.: ICES receives statistics from some countries only for Divisions VIIg-k combined and not for each Division separately. The figures up to 1982 and 1987 onwards are provided by members of the Working Group; from 1983-1986, they are figures submitted to the EC by member states.

Table 4.4.2 Celtic Sea PLAICE. English and Belgian CPUE and effort series 1972-1994.

Year	CPUE				Effort ('000 hours)		
	English[1]			Belgian[2]	English[3]		Belgian[4]
	Beam trawl survey[5]	Otter trawl	Beam trawl	Beam trawl	Otter trawl	Beam trawl	Beam trawl
1972		7.70	-	9.63	45.7	-	12.00
1973		7.54	-	8.51	45.3	-	23.28
1974		4.99	-	7.25	38.9	-	24.58
1975		4.88	-	5.13	33.5	-	21.26
1976		4.54	-	7.41	25.6	-	33.46
1977		4.06	-	6.93	27.2	-	28.82
1978		4.19	3.06	8.05	27.1	2.5	21.17
1979		5.31	3.62	6.60	23.8	2.0	22.68
1980		5.91	4.27	9.50	26.4	4.3	34.78
1981		5.36	3.50	7.51	24.1	6.2	42.31
1982		4.82	5.10	8.26	19.2	10.0	36.07
1983		6.05	3.92	6.69	17.6	12.4	38.01
1984		6.15	6.41	6.59	23.2	13.5	37.83
1985		6.98	6.38	9.81	25.2	18.7	45.00
1986		6.62	5.22	10.12	21.2	20.7	57.36
1987		6.60	4.32	12.07	24.4	38.8	42.82
1988	11.37	10.04	8.53	11.76	20.1	25.6	48.11
1989	13.06	7.40	5.63	11.66	17.6	20.3	60.42
1990	14.41	4.16	3.93	14.81	22.6	30.8	43.54
1991	11.67	2.87	3.58	15.18	18.6	40.8	20.22
1992	10.66	2.78	2.26	8.26	16.0	35.8	27.41
1993	5.02	2.72	2.84	10.22	13.8	39.6	32.81
1994	4.10	2.71	2.47	7.15	7.5	37.0	38.76

[1]Whole weight (kg) per corrected hour fished, VIIf only.
[2]Whole weight (kg) per corrected hour fished..
[3]Corrected for fishing power, VIIf only.
[4]Correced for fishing power (HP)
[5]Kg/10 km.

Table 4.4.3 **Celtic Sea Plaice**
Annual length distributions by fleet 1994.

Length (cm)*	UK (England & Wales) Beam traw	UK (England & Wales) All gears (minus beam)	Belgium All gears
22		322	
23		489	
24	800	1211	
25	1642	3825	
26	4964	9800	50072
27	10358	14897	54495
28	18041	22778	137568
29	20080	26651	144859
30	34732	27499	93227
31	32071	30219	88907
32	24473	25214	70499
33	27318	22571	70474
34	23911	17265	43336
35	16279	14941	28414
36	15334	13263	25213
37	10603	11054	5300
38	6810	6629	15635
39	5751	6317	13782
40	6581	3717	3055
41	4885	5207	8890
42	4268	5509	6747
43	5013	1627	4202
44	5017	1200	5431
45	3604	2536	3329
46	1986	871	3762
47	3761	313	2029
48	1536	279	1995
49	2753	132	1101
50	1627	132	286
51	1035	123	638
52	604	31	0
53	847	39	52
54	679	94	872
55	102	75	43
56	475	0	
57	158	0	
58	26	0	
59	76	16	
60		16	
61		16	
Total	298200	276878	884213

* Lower limit for UK data, nearest cm. for Belgium.

Table 4.4.4

Run title : CELTIC SEA PLAICE,1995 WG,COMBSEX,PLUSGROUP.

At 29/08/1995 15:16

Table 1 Catch numbers at age				Numbers*10**-3				
YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE								
1,	48,	118,	244,	150,	28,	110,	0,	0,
2,	989,	851,	877,	1921,	822,	300,	750,	704,
3,	426,	903,	673,	1207,	2111,	1180,	560,	918,
4,	411,	291,	638,	658,	681,	955,	827,	343,
5,	105,	136,	72,	146,	109,	443,	372,	373,
6,	72,	76,	70,	21,	54,	86,	92,	209,
7,	37,	47,	34,	16,	53,	51,	44,	70,
8,	59,	23,	8,	16,	11,	14,	27,	41,
9,	28,	33,	7,	8,	13,	14,	6,	15,
10,	15,	36,	18,	5,	11,	10,	6,	7,
11,	9,	8,	8,	7,	5,	18,	1,	8,
12,	12,	8,	3,	3,	4,	9,	4,	3,
13,	0,	7,	3,	2,	3,	1,	1,	5,
14,	10,	2,	3,	2,	2,	2,	1,	1,
+gp,	1,	4,	4,	5,	6,	6,	4,	3,
TOTALNUM,	2222,	2543,	2662,	4167,	3913,	3199,	2695,	2700,
TONSLAND,	757,	875,	863,	1373,	1377,	1303,	1146,	1210,
SOPCOF %,	100,	100,	100,	100,	100,	100,	100,	100,

Table 1 Catch numbers at age				Numbers*10**-3					
YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	73,	0,	48,	23,	6,	6,	82,	18,	25,	102,
2,	1461,	703,	434,	967,	797,	164,	279,	800,	1019,	433,
3,	2503,	2595,	1883,	2099,	3550,	2078,	1072,	526,	1179,	947,
4,	393,	1332,	1812,	1568,	1807,	2427,	1193,	357,	284,	741,
5,	102,	156,	772,	612,	741,	655,	578,	471,	139,	166,
6,	177,	59,	156,	413,	160,	242,	179,	275,	185,	118,
7,	62,	48,	22,	65,	98,	86,	94,	80,	115,	87,
8,	25,	32,	125,	16,	24,	70,	78,	21,	61,	94,
9,	26,	10,	45,	24,	7,	13,	47,	35,	26,	33,
10,	3,	5,	13,	23,	8,	17,	8,	16,	14,	13,
11,	2,	2,	9,	9,	2,	6,	0,	32,	6,	3,
12,	3,	1,	0,	9,	2,	5,	6,	5,	7,	11,
13,	2,	5,	0,	0,	2,	3,	10,	0,	0,	0,
14,	0,	0,	7,	0,	0,	0,	1,	0,	2,	3,
+gp,	2,	1,	2,	8,	2,	2,	7,	8,	4,	3,
TOTALNUM,	4834,	4949,	5328,	5836,	7206,	5774,	3634,	2644,	3066,	2754,
TONSLAND,	1752,	1691,	1901,	2116,	2151,	2082,	1501,	1188,	1114,	1086,
SOPCOF %,	100,	100,	100,	100,	100,	100,	100,	100,	100,	100,

Table 4.4.5

Run title : CELTIC SEA PLAICE,1995 WG,COMBSEX,PLUSGROUP.

At 29/08/1995 15:16

Table 2 Catch weights at age (kg)

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE								
1,	.0780,	.1940,	.0760,	.1180,	.1850,	.1510,	.1780,	.2760,
2,	.2050,	.2580,	.2030,	.2380,	.2550,	.2450,	.2740,	.3240,
3,	.3230,	.3230,	.3250,	.3540,	.3300,	.3390,	.3690,	.3840,
4,	.4300,	.3890,	.4400,	.4670,	.4120,	.4330,	.4640,	.4550,
5,	.5280,	.4570,	.5500,	.5760,	.5000,	.5260,	.5590,	.5380,
6,	.6150,	.5250,	.6520,	.6820,	.5950,	.6200,	.6540,	.6330,
7,	.6930,	.5950,	.7490,	.7840,	.6950,	.7140,	.7490,	.7390,
8,	.7600,	.6660,	.8390,	.8820,	.8020,	.8080,	.8440,	.8570,
9,	.8180,	.7380,	.9230,	.9770,	.9150,	.9020,	.9390,	.9860,
10,	.8660,	.8120,	1.0010,	1.0690,	1.0340,	.9960,	1.0340,	1.1270,
11,	.9030,	.8860,	1.0730,	1.1570,	1.1600,	1.0900,	1.1290,	1.2800,
12,	.9310,	.9620,	1.1380,	1.2410,	1.2920,	1.1840,	1.2240,	1.4440,
13,	.9490,	1.0390,	1.1970,	1.3220,	1.4300,	1.2780,	1.3190,	1.6200,
14,	.9570,	1.1170,	1.2500,	1.4000,	1.5740,	1.3730,	1.4140,	1.8070,
+gp,	.9550,	1.1970,	1.2970,	1.4740,	1.7250,	1.4670,	1.5090,	2.0060,
SOPCOFAC,	1.0003,	.9996,	1.0006,	1.0005,	1.0005,	.9997,	.9997,	1.0003,

Table 2 Catch weights at age (kg)

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	.1350,	.0000,	.1290,	.2600,	.1020,	.2400,	.2000,	.1480,	.1720,	.1450,
2,	.2510,	.1600,	.2080,	.2880,	.1760,	.2700,	.2600,	.2570,	.2470,	.2400,
3,	.3630,	.3010,	.2880,	.3250,	.2550,	.3090,	.3270,	.3620,	.3260,	.3310,
4,	.4700,	.4340,	.3680,	.3700,	.3370,	.3580,	.4000,	.4640,	.4070,	.4200,
5,	.5720,	.5590,	.4490,	.4230,	.4230,	.4160,	.4810,	.5630,	.4920,	.5060,
6,	.6700,	.6770,	.5300,	.4840,	.5140,	.4830,	.5670,	.6580,	.5800,	.5890,
7,	.7630,	.7870,	.6120,	.5540,	.6080,	.5600,	.6610,	.7500,	.6710,	.6700,
8,	.8510,	.8890,	.6940,	.6330,	.7060,	.6460,	.7610,	.8390,	.7650,	.7470,
9,	.9350,	.9830,	.7770,	.7200,	.8090,	.7410,	.8680,	.9240,	.8630,	.8220,
10,	1.0140,	1.0690,	.8600,	.8150,	.9150,	.8460,	.9810,	1.0060,	.9630,	.8940,
11,	1.0890,	1.1480,	.9440,	.9180,	1.0250,	.9590,	1.1010,	1.0840,	1.0660,	.9640,
12,	1.1590,	1.2180,	1.0290,	1.0300,	1.1400,	1.0830,	1.2280,	1.1590,	1.1730,	1.0300,
13,	1.2240,	1.2810,	1.1130,	1.1500,	1.2580,	1.2150,	1.3620,	1.2310,	1.2820,	1.0940,
14,	1.2840,	1.3360,	1.1990,	1.2780,	1.3800,	1.3570,	1.5020,	1.2990,	1.3950,	1.1550,
+gp,	1.3400,	1.3840,	1.2850,	1.4150,	1.5070,	1.5080,	1.6490,	1.3640,	1.5110,	1.2130,
SOPCOFAC,	.9991,	.9997,	1.0002,	.9997,	1.0004,	1.0003,	1.0004,	1.0001,	.9993,	1.0005,

Table 4.4.6

Run title : CELTIC SEA PLAICE,1995 WG,COMBSEX,PLUSGROUP.

At 29/08/1995 15:16

Table 3 Stock weights at age (kg)

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE								
1,	.1120,	.0860,	.1070,	.1090,	.0820,	.0960,	.1030,	.2560,
2,	.2160,	.1700,	.2120,	.2170,	.1670,	.1920,	.2060,	.2980,
3,	.3150,	.2520,	.3130,	.3220,	.2570,	.2880,	.3070,	.3520,
4,	.4060,	.3340,	.4120,	.4260,	.3500,	.3830,	.4080,	.4180,
5,	.4920,	.4140,	.5070,	.5280,	.4470,	.4790,	.5070,	.4950,
6,	.5700,	.4930,	.5990,	.6280,	.5480,	.5740,	.6060,	.5840,
7,	.6420,	.5700,	.6890,	.7270,	.6530,	.6680,	.7040,	.6850,
8,	.7070,	.6460,	.7750,	.8230,	.7620,	.7630,	.8010,	.7970,
9,	.7660,	.7210,	.8590,	.9180,	.8750,	.8570,	.8970,	.9200,
10,	.8180,	.7940,	.9390,	1.0110,	.9920,	.9510,	.9930,	1.0550,
11,	.8640,	.8660,	1.0160,	1.1020,	1.1120,	1.0450,	1.0870,	1.2020,
12,	.9030,	.9360,	1.0910,	1.1910,	1.2360,	1.1380,	1.1810,	1.3610,
13,	.9350,	1.0050,	1.1620,	1.2790,	1.3650,	1.2320,	1.2730,	1.5310,
14,	.9610,	1.0730,	1.2310,	1.3650,	1.4970,	1.3250,	1.3650,	1.7120,
+gp,	.9800,	1.1400,	1.2960,	1.4490,	1.6330,	1.4180,	1.4560,	1.9050,

Table 3 Stock weights at age (kg)

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
1,	.0750,	.0000,	.0890,	.2490,	.0660,	.2280,	.1730,	.0920,	.1350,	.0970,
2,	.1930,	.0870,	.1680,	.2730,	.1390,	.2540,	.2290,	.2030,	.2090,	.1930,
3,	.3070,	.2320,	.2480,	.3050,	.2150,	.2880,	.2930,	.3100,	.2860,	.2860,
4,	.4170,	.3690,	.3280,	.3460,	.2950,	.3320,	.3630,	.4140,	.3660,	.3760,
5,	.5210,	.4980,	.4080,	.3950,	.3800,	.3860,	.4400,	.5140,	.4500,	.4630,
6,	.6210,	.6190,	.4890,	.4530,	.4680,	.4480,	.5230,	.6110,	.5360,	.5480,
7,	.7170,	.7330,	.5710,	.5180,	.5600,	.5200,	.6130,	.7050,	.6250,	.6300,
8,	.8080,	.8390,	.6530,	.5930,	.6570,	.6020,	.7100,	.7950,	.7180,	.7090,
9,	.8940,	.9370,	.7360,	.6750,	.7570,	.6920,	.8130,	.8820,	.8130,	.7850,
10,	.9750,	1.0270,	.8190,	.7660,	.8610,	.7920,	.9240,	.9650,	.9120,	.8590,
11,	1.0520,	1.1090,	.9020,	.8650,	.9700,	.9010,	1.0400,	1.0450,	1.0140,	.9290,
12,	1.1240,	1.1840,	.9860,	.9730,	1.0820,	1.0200,	1.1640,	1.1220,	1.1190,	.9970,
13,	1.1920,	1.2510,	1.0710,	1.0890,	1.1980,	1.1480,	1.2940,	1.1960,	1.2270,	1.0620,
14,	1.2550,	1.3100,	1.1560,	1.2130,	1.3190,	1.2850,	1.4310,	1.2660,	1.3380,	1.1250,
+gp,	1.3130,	1.3610,	1.2420,	1.3450,	1.4430,	1.4310,	1.5740,	1.3320,	1.4530,	1.1840,

Table 4.4.7 PLE-CELT: Plaice in the Celtic Sea (Fishing Areas VIIf and VIIg)

FLT13: Belgium B/T - FORcor

Year	Fishing effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10
1977	28.82	109.4	125.8	34.6	18.2	14.0	12.9	10.2	6.1
1978	21.17	205.6	63.7	31.3	13.0	4.5	3.7	7.8	0.8
1979	22.68	176.3	57.9	15.8	5.6	7.6	3.6	3.9	1.3
1980	34.78	458.8	205.6	54.1	12.7	7.7	5.5	3.8	3.4
1981	42.31	502.0	125.3	55.2	14.9	10.3	4.4	5.0	1.6
1982	36.07	332.1	257.3	69.9	14.5	14.1	3.9	4.1	2.2
1983	38.01	192.9	190.3	126.3	24.5	13.2	11.0	2.0	1.9
1984	37.83	199.1	153.7	90.1	34.3	15.0	9.4	2.8	0.4
1985	45.00	910.1	190.3	82.7	57.4	13.3	3.4	2.4	1.4
1986	57.36	990.0	412.4	60.0	39.3	14.3	11.2	3.6	2.5
1987	42.82	714.3	451.6	98.1	11.3	11.9	17.9	4.5	0.6
1988	48.11	820.9	422.6	107.2	58.0	13.7	4.4	5.2	2.9
1989	60.42	841.0	979.7	442.3	70.7	34.8	17.9	3.7	5.5
1990	43.54	846.4	746.9	188.4	49.4	19.6	5.9	0.7	1.5
1991	20.22	437.0	263.0	63.0	6.0	9.0	2.0	3.0	1.0
1992	27.41	304.0	101.0	81.0	42.0	11.0	2.0	2.0	1.0
1993	32.81	382.2	91.5	34.1	31.5	17.3	6.3	2.3	1.1
1994	38.76	431.7	282.1	77.9	27.3	28.1	19.3	4.9	0.2

PLE-CELT: Plaice in the Celtic Sea (Fishing Areas VIIf and VIIg)

FLT11: UK(E+W) OTTER TRAWL 107F

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9
1989	17.6	1	91	256	62	23	7	5	0	0
1990	22.6	0	6	97	129	34	13	4	4	1
1991	18.6	5	14	47	79	37	16	4	5	3
1992	16.0	4	68	15	12	18	8	1	0	1
1993	13.8	1	25	42	9	4	6	4	3	1
1994	9.5	4	12	21	15	3	3	1	2	1

PLE-CELT: Plaice in the Celtic Sea (Fishing Areas VIIf and VIIg)

FLT10: UK (E+W) BEAM TRAWL 107F.

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9
1990	30.8	0	2	68	160	46	27	11	9	2
1991	40.8	9	23	74	141	87	29	15	14	10
1992	35.8	2	40	27	32	47	27	7	2	4
1993	39.6	1	41	140	25	16	25	15	7	4
1994	37.0	13	32	52	49	9	9	8	10	3

PLE-CELT: Plaice in the Celtic Sea (Fishing Areas VIIf and VIIg)

FLT14: E+W B/T Survey

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5
1988	74.12	77	271	69	0	2
1989	91.91	206	313	72	15	5
1990	69.86	161	215	64	15	6
1991	123.41	841	33	65	21	12
1992	125.08	487	307	13	5	15
1993	127.67	120	107	44	2	5
1994	120.82	127	40	20	11	1

Table 4.4.8

Extended Survivors Analysis

Plaice, Celtic Sea (run: XSA95/X95)

CPUE data from file /users/fish/ifad/ifapwork/wgssds/ple_celt/FLEET.X95

Catch data for 18 years. 1977 to 1994. Ages 1 to 9.

Fleet,	First, year,	Last, year,	First, age ,	Last, age	Alpha,	Beta
FLT10: UK (E+W) BEAM,	1990,	1994,	1,	8,	.000,	1.000
FLT11: UK(E+W) OTTER,	1989,	1994,	1,	8,	.000,	1.000
FLT13: Belgium B/T -,	1977,	1994,	3,	8,	.000,	1.000
FLT14: E+W B/T Surve,	1988,	1994,	1,	5,	.750,	.850

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :

Catchability independent of stock size for all ages

Catchability independent of age for ages >= 7

Terminal population estimation :

Survivor estimates shrunk towards the mean F
of the final 5 years or the 4 oldest ages.

S.E. of the mean to which the estimates are shrunk = .800

Minimum standard error for population
estimates derived from each fleet = .300

Prior weighting not applied

Tuning had not converged after 30 iterations

Total absolute residual between iterations
29 and 30 = .00103

Final year F values

Age ,	1,	2,	3,	4,	5,	6,	7,	8
Iteration 29,	.0109,	.3331,	.6521,	.7134,	1.0329,	.9083,	.5066,	.7722
Iteration 30,	.0109,	.3331,	.6522,	.7134,	1.0330,	.9085,	.5068,	.7726

Log catchability residuals.

Fleet : FLT10: UK (E+W) BEAM

Age ,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994
1 ,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	.66,	-.50,	-.55,	.40
2 ,	99.99,	99.99,	99.99,	99.99,	99.99,	-2.15,	.45,	.24,	.43,	.99
3 ,	99.99,	99.99,	99.99,	99.99,	99.99,	-.49,	.28,	-.19,	.46,	-.06
4 ,	99.99,	99.99,	99.99,	99.99,	99.99,	.22,	.24,	-.07,	-.11,	-.28
5 ,	99.99,	99.99,	99.99,	99.99,	99.99,	.12,	.22,	.06,	-.23,	-.16
6 ,	99.99,	99.99,	99.99,	99.99,	99.99,	.39,	.08,	-.27,	-.08,	-.11
7 ,	99.99,	99.99,	99.99,	99.99,	99.99,	.12,	.69,	-.37,	-.13,	-.31
8 ,	99.99,	99.99,	99.99,	99.99,	99.99,	.66,	.87,	-.38,	.26,	.25

Table 4.4.8 (cont'd.)

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time.

Age ,	1,	2,	3,	4,	5,	6,	7,	8
Mean Log q,	-10.5892,	-8.3073,	-6.8838,	-6.3922,	-6.3413,	-6.1830,	-6.3722,	-6.3722,
S.E(Log q),	.6193,	1.2245,	.3762,	.2252,	.1901,	.2496,	.4317,	.6052,

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
1,	.61,	1.461,	9.72,	.88,	4,	.32,	-10.59,
2,	1.84,	-.276,	8.71,	.03,	5,	2.58,	-8.31,
3,	1.18,	-.359,	6.72,	.58,	5,	.50,	-6.88,
4,	.84,	1.531,	6.54,	.97,	5,	.16,	-6.39,
5,	.80,	4.976,	6.38,	1.00,	5,	.06,	-6.34,
6,	1.04,	-.118,	6.19,	.73,	5,	.30,	-6.18,
7,	-33.73,	-1.193,	-25.38,	.00,	5,	13.84,	-6.37,
8,	.55,	1.685,	5.47,	.82,	5,	.22,	-6.04,

Fleet : FLT11: UK(E+W) OTTER

Age ,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994
1 ,	99.99,	99.99,	99.99,	99.99,	-.72,	99.99,	.30,	.43,	-.06,	.02
2 ,	99.99,	99.99,	99.99,	99.99,	.44,	-1.62,	-.14,	.70,	.12,	.49
3 ,	99.99,	99.99,	99.99,	99.99,	.47,	-.22,	.22,	-.36,	-.09,	.00
4 ,	99.99,	99.99,	99.99,	99.99,	-.04,	.25,	.39,	-.30,	-.13,	-.16
5 ,	99.99,	99.99,	99.99,	99.99,	-.01,	.19,	.21,	-.03,	-.50,	.16
6 ,	99.99,	99.99,	99.99,	99.99,	-.34,	.18,	.49,	-.47,	-.24,	.37
7 ,	99.99,	99.99,	99.99,	99.99,	.46,	.00,	.74,	-.92,	.19,	-.44
8 ,	99.99,	99.99,	99.99,	99.99,	99.99,	.74,	1.21,	99.99,	1.05,	.59

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age ,	1,	2,	3,	4,	5,	6,	7,	8
Mean Log q,	-10.0283,	-7.4311,	-6.4921,	-6.3327,	-6.4015,	-6.3982,	-6.9577,	-6.9577,
S.E(Log q),	.4433,	.8444,	.3002,	.2678,	.2683,	.4009,	.6104,	1.0785,

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
1,	.82,	.570,	9.71,	.77,	5,	.40,	-10.03,
2,	.69,	.598,	7.60,	.48,	6,	.62,	-7.43,
3,	.79,	1.441,	6.80,	.93,	6,	.22,	-6.49,
4,	.80,	1.954,	6.55,	.96,	6,	.17,	-6.33,
5,	.87,	.855,	6.43,	.91,	6,	.24,	-6.40,
6,	3.06,	-1.640,	7.13,	.14,	6,	1.06,	-6.40,
7,	1.43,	-.215,	7.60,	.06,	6,	.98,	-6.96,
8,	-9.67,	-1.465,	-5.66,	.01,	4,	2.33,	-6.06,

Table 4.4.8 (cont'd.)

Fleet : FLT13: Belgium B/T -

Age	1977	1978	1979	1980	1981	1982	1983	1984
1	No data for this fleet at this age							
2	No data for this fleet at this age							
3	-.11	.12	-.06	.11	-.31	-.42	-.03	-.41
4	.40	.34	-.49	.35	-.79	-.09	-.48	.43
5	.05	.43	-.14	.10	-.14	-.09	.19	-.29
6	.68	.45	-.07	.11	-.41	-.35	.15	.16
7	.88	.51	.45	.48	.27	.14	-.01	.35
8	.42	.60	1.19	.26	.21	.29	.39	.28

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	-.19	-.35	-.29	-.32	-.83	.04	1.11	.85	.00	.36
4	-.03	-.65	-.10	-.32	.31	.17	.33	.10	.13	.18
5	.65	-.61	-.80	-.42	.70	.23	-.35	-.08	-.23	1.00
6	.17	.74	-.88	-.07	.19	.32	-1.12	.11	.01	.63
7	-.21	-1.02	.37	-.02	.02	-.20	.33	-.20	-.35	.35
8	-.51	-.01	.22	-.26	.73	-.66	-.93	-.67	-.21	.31

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	3	4	5	6	7	8
Mean Log q	-5.2402	-5.1482	-5.3910	-5.8530	-5.8199	-5.8199
S.E(Log q)	.5452	.3471	.5348	.5339	.3962	.5395

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	2.71	-3.330	.30	.28	18	1.07	-5.24
4	1.16	-.900	4.76	.75	18	.41	-5.15
5	1.57	-1.542	4.71	.42	18	.79	-5.39
6	1.41	-.892	5.84	.32	18	.76	-5.85
7	2.28	-2.611	6.64	.29	18	.73	-5.82
8	1.24	-.651	6.23	.42	18	.68	-5.89

Fleet : FLT14: E+W B/T Surve

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	99.99	99.99	99.99	-1.30	.42	.82	1.00	.64	-.03	-1.60
2	99.99	99.99	99.99	-.15	.30	1.09	-.88	.46	-.29	-.50
3	99.99	99.99	99.99	.11	-.32	.37	.86	-.43	-.15	-.44
4	99.99	99.99	99.99	99.99	.12	.24	.34	-.11	-.72	.14
5	99.99	99.99	99.99	-.85	-.18	.32	.08	.65	.35	-.43
6	No data for this fleet at this age									
7	No data for this fleet at this age									
8	No data for this fleet at this age									

Table 4.4.8 (cont'd.)

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age ,	1,	2,	3,	4,	5
Mean Log q,	-7.4527,	-7.6316,	-8.3910,	-9.2130,	-9.0548,
S.E(Log q),	1.0419,	.6646,	.4864,	.3848,	.5099,

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
1,	-8.54,	-2.101,	15.22,	.01,	7,	7.07,	-7.45,
2,	.78,	.659,	7.75,	.65,	7,	.55,	-7.63,
3,	.95,	.167,	8.37,	.68,	7,	.51,	-8.39,
4,	.71,	2.861,	8.69,	.96,	6,	.17,	-9.21,
5,	.94,	.180,	8.91,	.65,	7,	.52,	-9.05,

Terminal year survivor and F summaries :

Age 1 Catchability constant w.r.t. time and dependent on age

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: UK (E+W) BEAM,	13057.,	.693,	.000,	.00,	1,	.240,	.007
FLT11: UK(E+W) OTTER,	8930.,	.486,	.000,	.00,	1,	.487,	.011
FLT13: Belgium B/T -,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT14: E+W B/T Surve,	1766.,	1.116,	.000,	.00,	1,	.092,	.053
F shrinkage mean ,	11110.,	.80,,,,				.182,	.009

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
8762.,	.34,	.31,	4,	.913,	.011

Age 2 Catchability constant w.r.t. time and dependent on age

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: UK (E+W) BEAM,	826.,	.616,	.629,	1.02,	2,	.202,	.401
FLT11: UK(E+W) OTTER,	1102.,	.429,	.228,	.53,	2,	.415,	.315
FLT13: Belgium B/T -,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT14: E+W B/T Surve,	714.,	.600,	.215,	.36,	2,	.214,	.452
F shrinkage mean ,	1823.,	.80,,,,				.169,	.202

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1032.,	.29,	.19,	7,	.669,	.333

Table 4.4.8 (cont'd.)

Age 3 Catchability constant w.r.t. time and dependent on age

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: UK (E+W) BEAM,	860.,	.347,	.150,	.43,	3,	.236,	.712
FLT11: UK(E+W) OTTER,	1072.,	.263,	.126,	.48,	3,	.405,	.605
FLT13: Belgium B/T -,	1394.,	.567,	.000,	.00,	1,	.095,	.495
FLT14: E+W B/T Surve,	720.,	.400,	.223,	.56,	3,	.172,	.806
F shrinkage mean ,	1017.,	.80,,,,				.092,	.630

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
970.,	.18,	.09,	11,	.495,	.652

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: UK (E+W) BEAM,	634.,	.235,	.204,	.87,	4,	.277,	.742
FLT11: UK(E+W) OTTER,	625.,	.206,	.109,	.53,	4,	.337,	.750
FLT13: Belgium B/T -,	776.,	.312,	.069,	.22,	2,	.167,	.641
FLT14: E+W B/T Surve,	771.,	.300,	.139,	.46,	4,	.162,	.645
F shrinkage mean ,	580.,	.80,,,,				.056,	.790

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
670.,	.13,	.07,	15,	.546,	.713

Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: UK (E+W) BEAM,	75.,	.205,	.033,	.16,	4,	.317,	1.128
FLT11: UK(E+W) OTTER,	86.,	.196,	.112,	.57,	4,	.336,	1.033
FLT13: Belgium B/T -,	152.,	.292,	.296,	1.01,	3,	.136,	.708
FLT14: E+W B/T Surve,	51.,	.289,	.129,	.45,	5,	.136,	1.406
F shrinkage mean ,	149.,	.80,,,,				.075,	.719

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
86.,	.12,	.10,	17,	.806,	1.033

Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: UK (E+W) BEAM,	66.,	.181,	.077,	.42,	5,	.393,	.988
FLT11: UK(E+W) OTTER,	64.,	.186,	.185,	1.00,	6,	.312,	1.009
FLT13: Belgium B/T -,	100.,	.283,	.231,	.82,	4,	.143,	.749
FLT14: E+W B/T Surve,	98.,	.293,	.183,	.62,	5,	.085,	.757
F shrinkage mean ,	132.,	.80,,,,				.068,	.610

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
75.,	.12,	.09,	21,	.750,	.909

Table 4.4.8 (cont'd.)

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: UK (E+W) BEAM,	113.,	.190,	.091,	.48,	5,	.384,	.547
FLT11: UK(E+W) OTTER,	109.,	.211,	.117,	.55,	6,	.261,	.560
FLT13: Belgium B/T -,	157.,	.273,	.084,	.31,	5,	.239,	.420
FLT14: E+W B/T Surve,	193.,	.295,	.150,	.51,	5,	.053,	.354
F shrinkage mean ,	108.,	.80,,,,				.062,	.566

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
124.,	.12,	.06,	22,	.481,	.507

Age 8 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1986

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: UK (E+W) BEAM,	75.,	.204,	.114,	.56,	5,	.360,	.782
FLT11: UK(E+W) OTTER,	83.,	.227,	.155,	.68,	6,	.220,	.728
FLT13: Belgium B/T -,	73.,	.265,	.141,	.53,	6,	.280,	.796
FLT14: E+W B/T Surve,	82.,	.320,	.097,	.30,	4,	.038,	.734
F shrinkage mean ,	73.,	.80,,,,				.102,	.795

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
76.,	.14,	.06,	22,	.425,	.773

Table 4.4.9

Run title : Plaice, Celtic Sea (run: XSA95/X95)

At 9-Sep-95 17:00:23

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE								
1,	.0141,	.0250,	.0319,	.0292,	.0141,	.0320,	.0000,	.0000,
2,	.3472,	.3339,	.2387,	.3397,	.2021,	.1883,	.2873,	.0995,
3,	.5376,	.5574,	.4361,	.5420,	.6955,	.4501,	.5728,	.6149,
4,	.8257,	.7946,	.9022,	.9230,	.6119,	.7185,	.5965,	.7635,
5,	.4223,	.6518,	.4133,	.4749,	.3331,	.9650,	.6193,	.5359,
6,	.6477,	.5601,	.7620,	.1843,	.2923,	.4333,	.4787,	.7838,
7,	.5490,	1.1105,	.4760,	.3488,	.8577,	.4487,	.3753,	.7481,
8,	.6019,	.7189,	.4955,	.3907,	.3909,	.5181,	.4125,	.6509,
+gp,	.6019,	.7189,	.4955,	.3907,	.3909,	.5181,	.4125,	.6509,
FBAR 3- 6,	.6083,	.6410,	.6284,	.5310,	.4832,	.6417,	.5668,	.6745,

Table 8 Fishing mortality (F) at age YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	FBAR 92-94
AGE											
1,	.0098,	.0000,	.0043,	.0034,	.0023,	.0033,	.0181,	.0049,	.0144,	.0109,	.0101,
2,	.1950,	.1133,	.0669,	.1028,	.1418,	.0725,	.1913,	.2246,	.3765,	.3331,	.3114,
3,	.5437,	.5642,	.4497,	.4739,	.5947,	.5938,	.8077,	.5944,	.5422,	.6522,	.5962,
4,	.5277,	.5681,	.9084,	.7618,	.8877,	.9842,	.7442,	.6286,	.6817,	.7134,	.6746,
5,	.4848,	.3726,	.6928,	.8294,	.9378,	.8776,	.5977,	.6768,	.4847,	1.0330,	.7315,
6,	.4769,	.5223,	.7114,	.9231,	.4794,	.8494,	.5673,	.5777,	.5595,	.9085,	.6819,
7,	.5074,	.2068,	.3402,	.6676,	.5207,	.4664,	.8822,	.4857,	.4599,	.5068,	.4841,
8,	.5945,	.4855,	1.1228,	.4039,	.5031,	.7991,	.9357,	.4412,	.7712,	.7726,	.6617,
+gp,	.5945,	.4855,	1.1228,	.4039,	.5031,	.7991,	.9357,	.4412,	.7712,	.7726,	
FBAR 3- 6,	.5083,	.5068,	.6906,	.7470,	.7249,	.8263,	.6792,	.6194,	.5670,	.8268,	

Table 4.4.10

Run title : Plaice, Celtic Sea (run: XSA95/X95)

At 9-Sep-95 17:00:23

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year)							Numbers*10**-3	
YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE								
1,	3640,	5069,	8245,	5538,	2122,	3713,	8899,	9873,
2,	3580,	3183,	4385,	7082,	4770,	1856,	3189,	7893,
3,	1088,	2244,	2022,	3063,	4472,	3457,	1364,	2122,
4,	776,	564,	1140,	1159,	1580,	1979,	1955,	682,
5,	324,	302,	226,	410,	409,	760,	856,	955,
6,	160,	188,	139,	132,	226,	260,	257,	408,
7,	93,	74,	95,	58,	98,	150,	149,	141,
8,	139,	48,	22,	53,	36,	37,	85,	91,
+gp,	175,	201,	124,	105,	144,	157,	72,	93,
TOTAL,	9975,	11873,	16397,	17600,	13858,	12367,	16825,	22258,

Table 10 Stock number at age (start of year)							Numbers*10**-3				
YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	GMST
AGE												
1,	7937,	8027,	11899,	7243,	2814,	1925,	4847,	3907,	1856,	9987,	0,	52
2,	8756,	6971,	7119,	10508,	6402,	2490,	1702,	4222,	3449,	1623,	8762,	46
3,	6337,	6390,	5520,	5906,	8409,	4928,	2054,	1246,	2991,	2099,	1032,	31
4,	1018,	3264,	3224,	3123,	3261,	4115,	2413,	812,	610,	1543,	970,	16
5,	282,	533,	1640,	1153,	1293,	1190,	1364,	1017,	384,	274,	670,	6
6,	496,	154,	325,	728,	446,	449,	439,	665,	458,	210,	86,	2
7,	165,	273,	81,	142,	256,	245,	170,	221,	331,	232,	75,	1
8,	59,	88,	197,	51,	64,	135,	136,	63,	120,	185,	124,	
+gp,	89,	66,	118,	232,	61,	88,	137,	284,	116,	129,	129,	
TOTAL,	25140,	25765,	30124,	29085,	23008,	15565,	13263,	12438,	10316,	16282,	11847,	

Table 4.4.11

Run title : Plaice, Celtic Sea (run: XSA95/X95)

At 9-Sep-95 17:00:23

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 3- 6,
1977,	3640,	2394,	1001,	757,	.7565,	.6083,
1978,	5069,	2187,	874,	875,	1.0017,	.6410,
1979,	8245,	3321,	1155,	863,	.7472,	.6284,
1980,	5538,	4124,	1508,	1373,	.9107,	.5310,
1981,	2122,	3233,	1593,	1377,	.8644,	.4832,
1982,	3713,	3272,	1821,	1303,	.7154,	.6417,
1983,	8899,	3632,	1688,	1146,	.6790,	.5668,
1984,	9873,	6902,	1760,	1210,	.6874,	.6745,
1985,	7937,	5363,	2123,	1752,	.8252,	.5083,
1986,	8027,	3998,	2419,	1691,	.6991,	.5068,
1987,	11899,	5782,	2568,	1901,	.7401,	.6906,
1988,	7243,	8637,	3038,	2116,	.6965,	.7470,
1989,	2814,	4789,	2510,	2151,	.8571,	.7249,
1990,	1925,	4801,	2581,	2082,	.8068,	.8263,
1991,	4847,	3872,	2020,	1501,	.7429,	.6792,
1992,	3907,	3358,	1811,	1188,	.6559,	.6194,
1993,	1856,	2873,	1394,	1114,	.7989,	.5670,
1994,	(9987,)	3095,	1315,	1086,	.8260,	.8268,
Arith. Mean	5975,	4202,	1843,	1416,	.7784,	.6373,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

(replace with GM)

Table 4.4.12

Plaice in the Celtic Sea (Fishing Areas VIIf and VIIg)

Single option prediction: Input data

Year: 1995								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	5246.000	0.1200	0.0000	0.2000	0.2000	0.108	0.0102	0.155
2	4603.000	0.1200	0.1500	0.2000	0.2000	0.202	0.3836	0.248
3	1032.000	0.1200	0.5300	0.2000	0.2000	0.294	0.7345	0.340
4	970.000	0.1200	0.9600	0.2000	0.2000	0.385	0.8311	0.430
5	670.000	0.1200	1.0000	0.2000	0.2000	0.476	0.9012	0.520
6	86.000	0.1200	1.0000	0.2000	0.2000	0.565	0.8401	0.609
7	75.000	0.1200	1.0000	0.2000	0.2000	0.653	0.5937	0.697
8	124.000	0.1200	1.0000	0.2000	0.2000	0.741	0.8152	0.784
9+	129.000	0.1200	1.0000	0.2000	0.2000	0.943	0.8152	0.985
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1996								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	5246.000	0.1200	0.0000	0.2000	0.2000	0.108	0.0102	0.155
2	.	0.1200	0.1500	0.2000	0.2000	0.202	0.3836	0.248
3	.	0.1200	0.5300	0.2000	0.2000	0.294	0.7345	0.340
4	.	0.1200	0.9600	0.2000	0.2000	0.385	0.8311	0.430
5	.	0.1200	1.0000	0.2000	0.2000	0.476	0.9012	0.520
6	.	0.1200	1.0000	0.2000	0.2000	0.565	0.8401	0.609
7	.	0.1200	1.0000	0.2000	0.2000	0.653	0.5937	0.697
8	.	0.1200	1.0000	0.2000	0.2000	0.741	0.8152	0.784
9+	.	0.1200	1.0000	0.2000	0.2000	0.943	0.8152	0.985
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	5246.000	0.1200	0.0000	0.2000	0.2000	0.108	0.0102	0.155
2	.	0.1200	0.1500	0.2000	0.2000	0.202	0.3836	0.248
3	.	0.1200	0.5300	0.2000	0.2000	0.294	0.7345	0.340
4	.	0.1200	0.9600	0.2000	0.2000	0.385	0.8311	0.430
5	.	0.1200	1.0000	0.2000	0.2000	0.476	0.9012	0.520
6	.	0.1200	1.0000	0.2000	0.2000	0.565	0.8401	0.609
7	.	0.1200	1.0000	0.2000	0.2000	0.653	0.5937	0.697
8	.	0.1200	1.0000	0.2000	0.2000	0.741	0.8152	0.784
9+	.	0.1200	1.0000	0.2000	0.2000	0.943	0.8152	0.985
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : SOPRED95
Date and time: 10SEP95:09:17

Table 4.4.13

Plaice in the Celtic Sea (Fishing Areas VIIf and VIIg)

Yield per recruit: Summary table

						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	8.843	5222.909	6.692	4843.426	6.533	4728.567
0.1000	0.0827	0.334	206.425	6.062	2838.932	3.929	2464.949	3.775	2368.338
0.2000	0.1653	0.478	259.139	4.871	1903.114	2.755	1534.346	2.606	1451.031
0.3000	0.2480	0.558	272.735	4.207	1426.614	2.107	1062.796	1.963	989.382
0.4000	0.3307	0.610	273.967	3.783	1147.806	1.699	788.690	1.559	722.822
0.5000	0.4134	0.646	271.112	3.488	969.285	1.419	614.639	1.283	554.660
0.6000	0.4960	0.672	267.067	3.272	847.289	1.216	496.897	1.084	441.623
0.7000	0.5787	0.693	262.889	3.105	759.631	1.063	413.290	0.935	361.858
0.8000	0.6614	0.709	258.951	2.972	694.059	0.944	351.579	0.819	303.351
0.9000	0.7441	0.722	255.364	2.864	643.361	0.848	304.563	0.726	259.054
1.0000	0.8267	0.734	252.133	2.775	603.068	0.770	267.784	0.651	224.620
1.1000	0.9094	0.743	249.232	2.698	570.292	0.705	238.363	0.589	197.250
1.2000	0.9921	0.752	246.621	2.633	543.102	0.650	214.380	0.536	175.079
1.3000	1.0747	0.759	244.263	2.576	520.166	0.604	194.510	0.492	156.827
1.4000	1.1574	0.765	242.125	2.525	500.538	0.563	177.815	0.454	141.589
1.5000	1.2401	0.771	240.177	2.481	483.534	0.528	163.619	0.421	128.712
1.6000	1.3228	0.776	238.396	2.441	468.644	0.497	151.418	0.392	117.713
1.7000	1.4054	0.781	236.759	2.405	455.486	0.470	140.836	0.367	108.231
1.8000	1.4881	0.785	235.251	2.372	443.762	0.446	131.582	0.344	99.989
1.9000	1.5708	0.789	233.856	2.342	433.243	0.424	123.431	0.324	92.770
2.0000	1.6535	0.793	232.562	2.314	423.744	0.405	116.205	0.306	86.407
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YPR95
Date and time : 10SEP95:09:29
Computation of ref. F: Simple mean, age 3 - 6
F-0.1 factor : 0.1652
F-max factor : 0.3657
F-0.1 reference F : 0.1366
F-max reference F : 0.3023
Recruitment : Single recruit

Table 4.4.14

Plaice in the Celtic Sea (Fishing Areas VIIf and VIIg)

Prediction with management option table

Year: 1995					Year: 1996					Year: 1997	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.8267	2802	1078	1115	0.0000	0.0000	2939	1164	0	4305	2283
.	.	.	.	.	0.1000	0.0827	.	1147	156	4139	2112
.	.	.	.	.	0.2000	0.1653	.	1130	302	3984	1956
.	.	.	.	.	0.3000	0.2480	.	1113	439	3839	1813
.	.	.	.	.	0.4000	0.3307	.	1096	568	3703	1681
.	.	.	.	.	0.5000	0.4134	.	1080	688	3576	1560
.	.	.	.	.	0.6000	0.4960	.	1064	801	3456	1449
.	.	.	.	.	0.7000	0.5787	.	1048	906	3345	1346
.	.	.	.	.	0.8000	0.6614	.	1033	1006	3240	1252
.	.	.	.	.	0.9000	0.7441	.	1017	1099	3142	1166
.	.	.	.	.	1.0000	0.8267	.	1002	1186	3049	1086
.	.	.	.	.	1.1000	0.9094	.	988	1268	2963	1013
.	.	.	.	.	1.2000	0.9921	.	973	1346	2882	946
.	.	.	.	.	1.3000	1.0747	.	959	1418	2805	883
.	.	.	.	.	1.4000	1.1574	.	944	1487	2733	826
.	.	.	.	.	1.5000	1.2401	.	931	1551	2666	773
.	.	.	.	.	1.6000	1.3228	.	917	1612	2602	724
.	.	.	.	.	1.7000	1.4054	.	903	1669	2543	679
.	.	.	.	.	1.8000	1.4881	.	890	1723	2486	638
.	.	.	.	.	1.9000	1.5708	.	877	1774	2433	599
.	.	.	.	.	2.0000	1.6535	.	864	1821	2383	564
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MOPRED95
Date and time : 10SEP95:09:27
Computation of ref. F: Simple mean, age 3 - 6
Basis for 1995 : F factors

Table 4.4.15

Plaice in the Celtic Sea (Fishing Areas VIIf and VIIg)

Single option prediction: Detailed tables

Year: 1995 F-factor: 1.0000 Reference F: 0.8267

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0102	50	8	5246	567	0	0	0	0
2	0.3836	1387	344	4603	928	690	139	624	126
3	0.7345	510	173	1032	303	547	161	461	136
4	0.8311	520	224	970	374	931	359	770	297
5	0.9012	378	197	670	319	670	319	546	260
6	0.8401	46	28	86	49	86	49	71	40
7	0.5937	32	22	75	49	75	49	65	42
8	0.8152	66	51	124	92	124	92	103	76
9+	0.8152	68	67	129	122	129	122	107	101
Total		3058	1115	12935	2802	3253	1289	2747	1078
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1996 F-factor: 1.0000 Reference F: 0.8267

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0102	50	8	5246	567	0	0	0	0
2	0.3836	1388	344	4606	929	691	139	625	126
3	0.7345	1374	467	2782	818	1474	433	1243	365
4	0.8311	235	101	439	169	422	162	349	134
5	0.9012	212	110	375	178	375	178	306	145
6	0.8401	130	79	241	136	241	136	199	113
7	0.5937	14	10	33	22	33	22	29	19
8	0.8152	19	15	37	27	37	27	30	23
9+	0.8152	53	52	99	94	99	94	82	78
Total		3475	1186	13858	2939	3372	1192	2862	1002
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1997 F-factor: 1.0000 Reference F: 0.8267

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0102	50	8	5246	567	0	0	0	0
2	0.3836	1388	344	4606	929	691	139	625	126
3	0.7345	1375	467	2783	818	1475	434	1243	366
4	0.8311	635	273	1184	456	1136	438	939	362
5	0.9012	96	50	170	81	170	81	138	66
6	0.8401	73	44	135	76	135	76	111	63
7	0.5937	39	27	92	60	92	60	80	52
8	0.8152	9	7	16	12	16	12	13	10
9+	0.8152	28	28	53	50	53	50	44	42
Total		3692	1248	14285	3049	3769	1290	3195	1086
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : SOPRED95
Date and time : 10SEP95:09:17
Computation of ref. F: Simple mean, age 3 - 6
Prediction basis : F factors

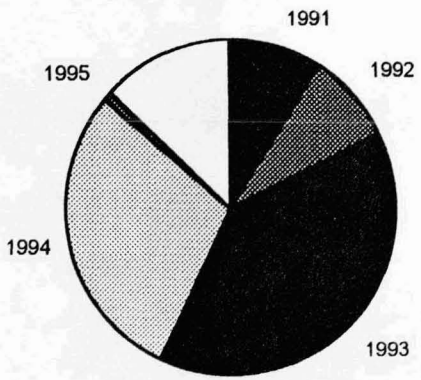
Table 4.4.16 Celtic Sea Plaice. Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class	1991	1992	1993	1994	1995
Stock No. (thousands) of one-year-olds	3907	1856	5246	5246	5246
Source	VPA	VPA	GM	GM	GM
Status Quo F:					
% in 1995 catch	20.1	15.5	30.9	0.7	-
% in 1996 catch	9.3	8.5	39.4	29.0	0.7
% in 1995 SSB	27.6	12.6	11.7	0.0	-
% in 1996 SSB	14.5	13.4	36.4	12.6	0.0
% in 1997 SSB	5.8	6.1	33.3	33.7	11.6

GM= geometric mean recruitment

VIIfg plaice : Year-class % contribution to a) 1996 landings and b) 1997 SSB

a



b

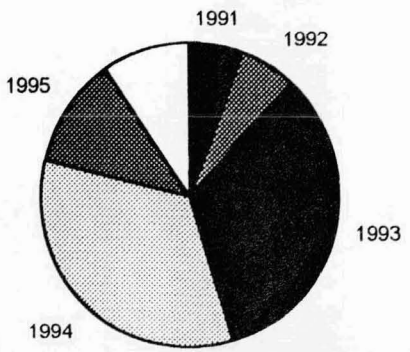


Figure 4.4.1

VIIfg PLAICE XSA LOG CATCHABILITY RESIDUAL PLOTS (AGES 1-6)

UK (E+W) BEAM TRAWL ■
UK(E&W) Otter ◆
Belgium B/T - FORcor ▲

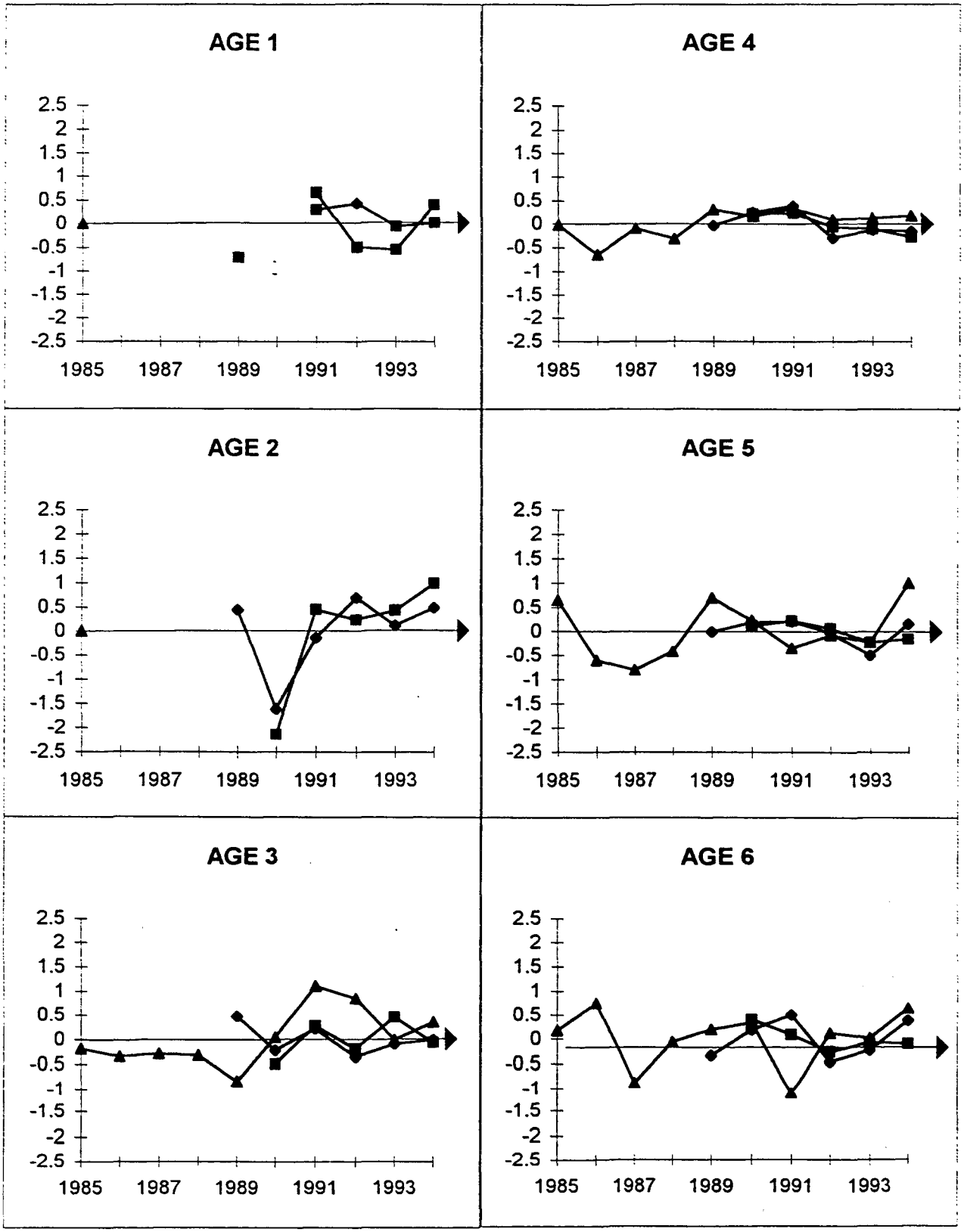
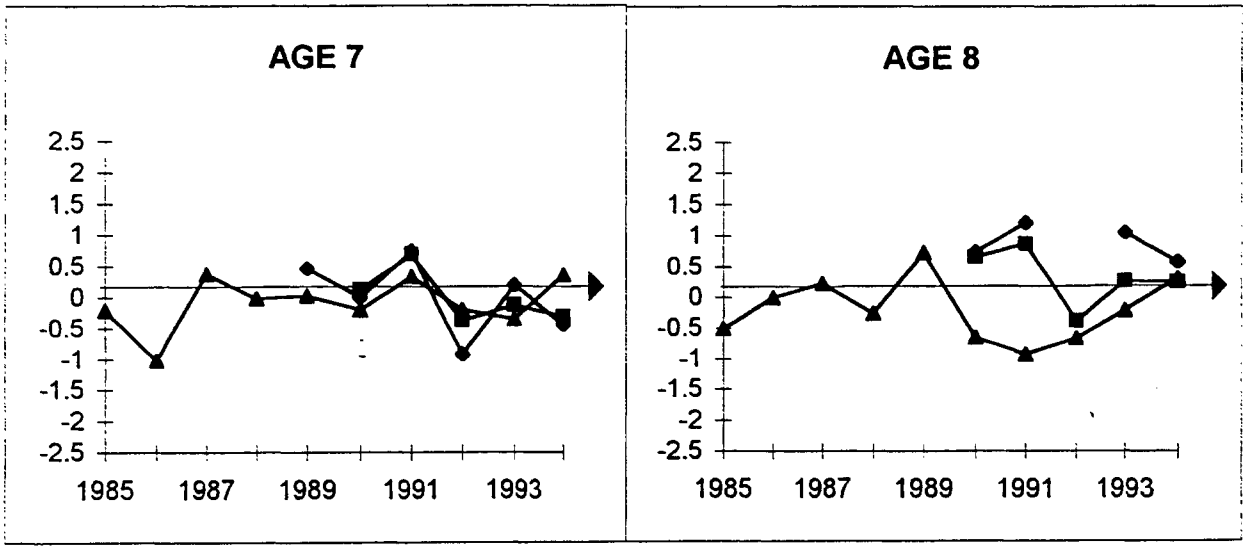


Figure 4.4.1 (cont'd.)

VIIfg PLAICE XSA LOG CATCHABILITY RESIDUAL PLOTS (AGES 1-6)

UK Inshore fleet ■
UK Ofshore fleet ◆
UK Beam trawl survey ▲

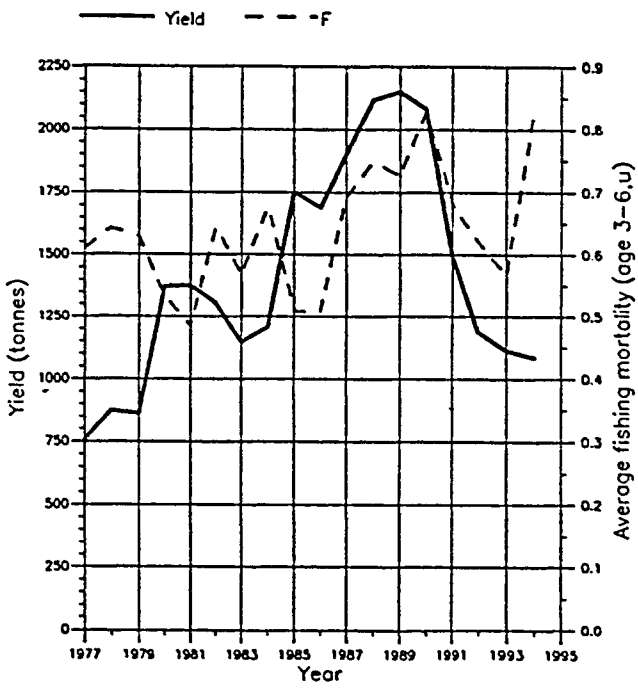


FISH STOCK SUMMARY

Figure 4.4.2 STOCK: Plaice in the Celtic Sea (Fishing Areas VIIf and VIIg)

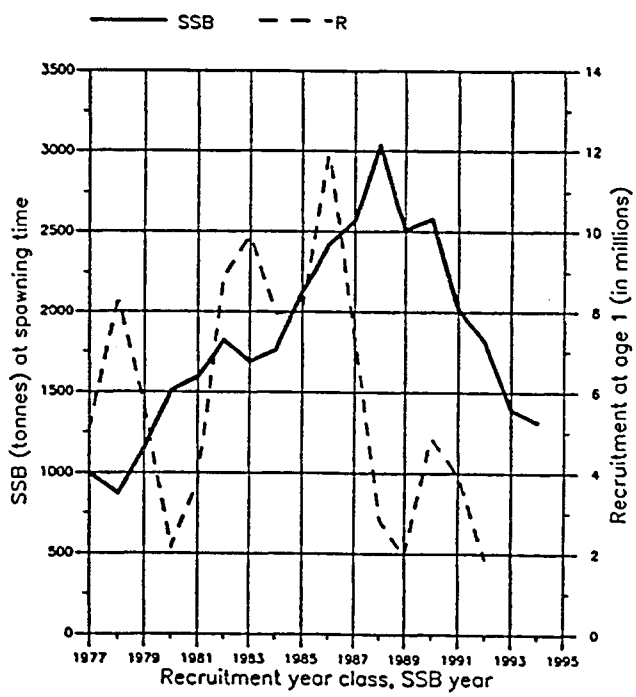
9–9–1995

Trends in yield and fishing mortality (F)



(run: XSA95) **A**

Trends in spawning stock biomass (SSB) and recruitment (R)



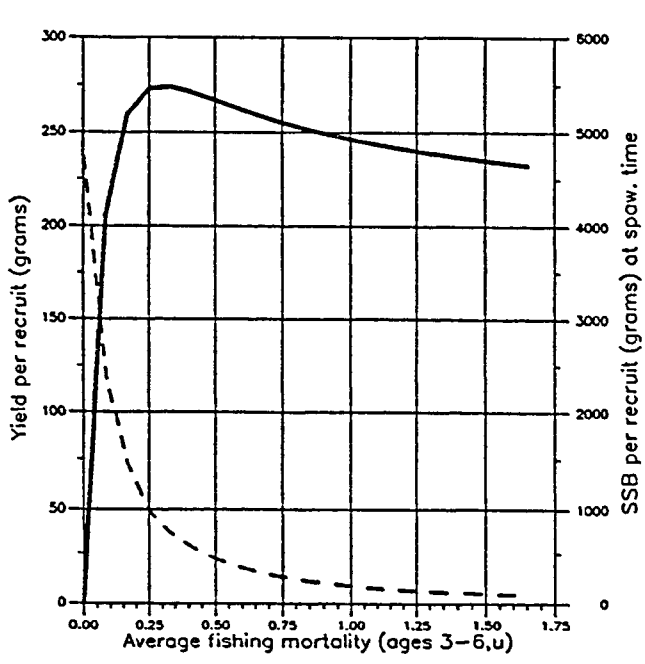
(run: XSA95) **B**

FISH STOCK SUMMARY

STOCK: Plaice in the Celtic Sea (Fishing Areas VIIf and VIIg)

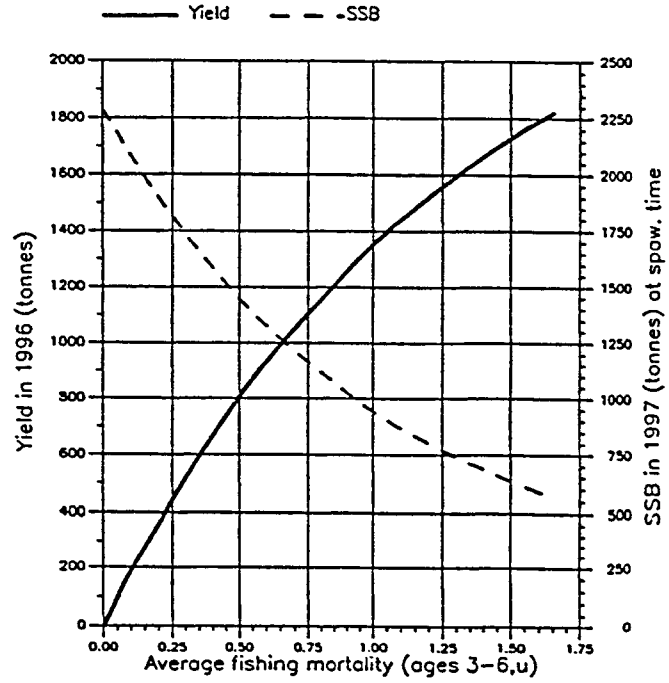
10–9–1995

Long term yield and spawning stock biomass



(run: YPR95) **C**

Short–term yield and spawning stock biomass



(run: MOPRED95) **D**

Figure 4.4.3 **Celtic Sea Plaice stock-recruitment**

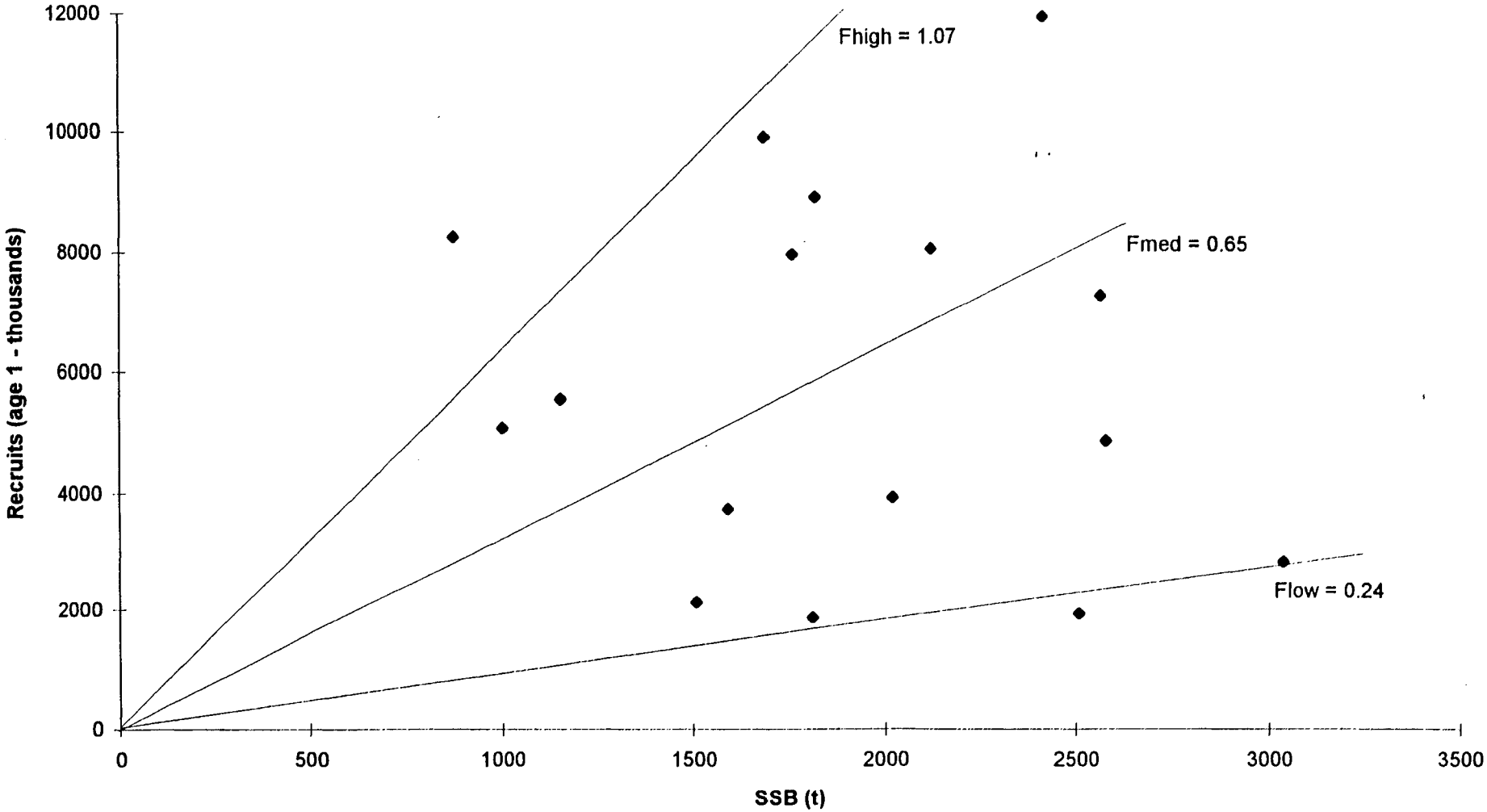
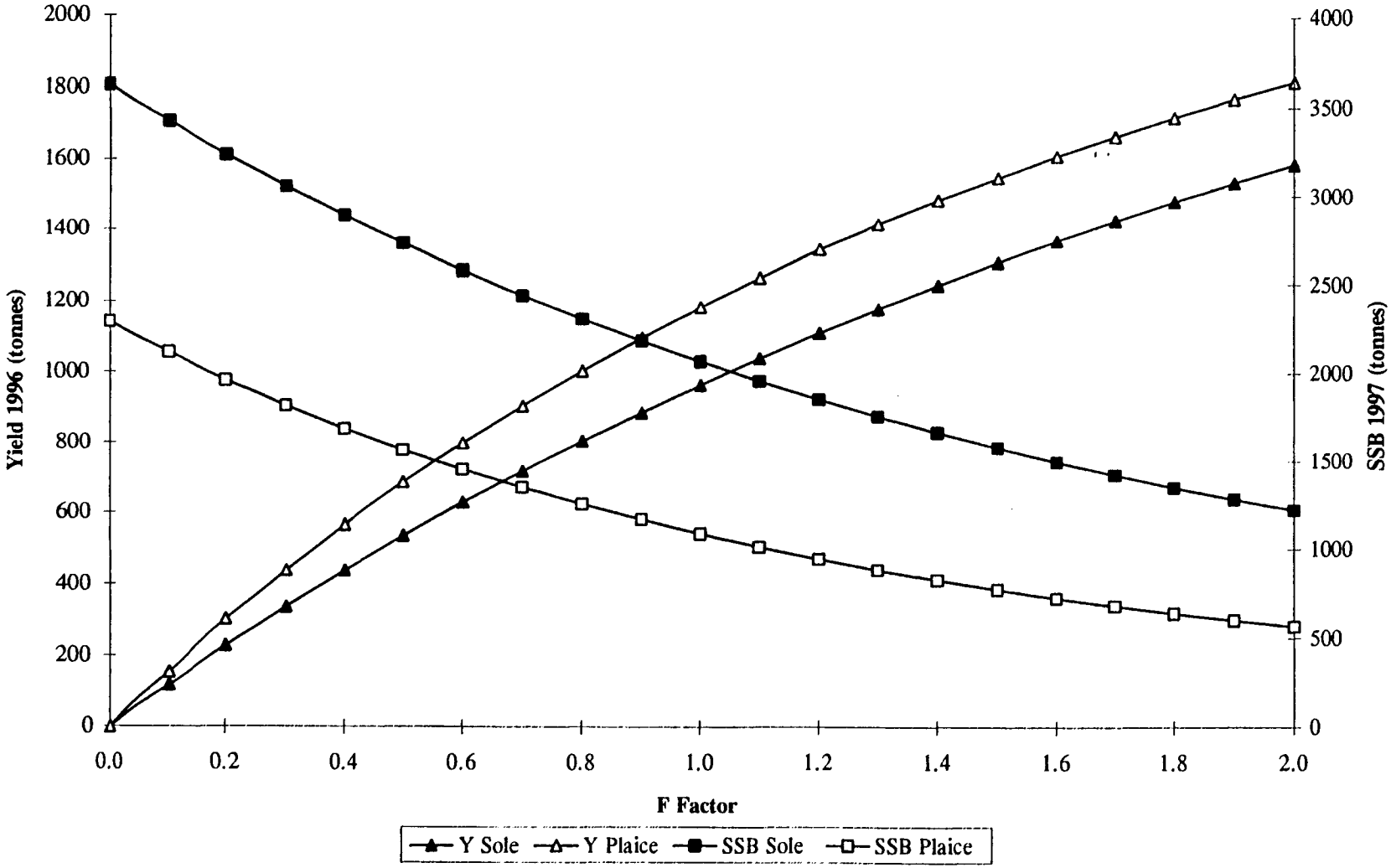


Figure 4.4.4

VIIf+g sole and plaice
Combined short-term forecast based on Status Quo in 1995



4.5 Stocks in Divisions VIIbc, h-k

Stocks of cod, whiting, plaice and sole in ICES Divisions VIIbc, h-k are not assessed analytically because, prior to 1993, aged-based data were not available. In 1993, Ireland initiated a comprehensive stock monitoring programme in these Divisions, with a view to providing an adequate time series of biological data for stock assessment purposes. A research vessel programme was also initiated in this area, comprising both annual ground fish (October) and young fish (July) surveys. However, there is, as yet, no information on the relative strength of recruitment from these surveys, and it will be some time before full analytical assessments, tuned with CPUE and research vessel data, can be carried out for these stocks. The 1994 results, in terms of length compositions are presented in this section. It should be noted that no fish were aged in 1994 and therefore age length keys are unavailable for 1994.

There are single cod and whiting TACs covering the whole of Divisions VIIb-k, which results in the problem of assessment areas not corresponding to management areas. Landings of cod, whiting, sole and plaice for Divisions VIIb,c,h-k are also often difficult to interpret, as several countries differ in the manner in which they report their landings data for the various ICES Divisions. However, unofficial data supplied to the Working Group by the respective countries enabled preliminary figures for Divisions VIIh-k to be estimated (Table 4.5.1).

CPUE data are available for all French fleets (1988-1994). UK (England and Wales) effort and CPUE information is available for these Divisions for only one year (1993) and is therefore not presented. No Irish effort or CPUE data is available.

4.5.1 Stocks in the west of Ireland (ICES Divisions VIIb,c)

4.5.1.1 West of Ireland cod, Divisions VIIb,c

Landings

Official international landings data are shown in Table 2.1.1. Preliminary 1994 landings of cod for Divisions VIIb,c (excluding the French landings) were 418 t, of which Ireland accounted for 69%. Irish landings of cod in these divisions have decreased steadily since 1989. The 1995 TAC for sub-area VII (excluding VIIa), VIII, IX, X and COPACE (EC) is 17,000t.

The reliability of these landings statistics may be uncertain, as the extent of mis-reporting is not known.

Commercial catch-effort data

CPUE data for Division VIIb,c were provided by France for all fleets (Table 4.5.2). These data show an increase in CPUE in the non-*Nephrops* trawl fleets in 1994. *Nephrops* trawl fleet CPUE shows a decrease since 1992.

International length compositions

The 1994 international length composition data for commercially caught cod in Divisions VIIb were derived using the Irish length frequency data, and are presented in Table 4.5.3. The length frequency pattern in 1994 is similar to that in 1993, although a peak cod numbers in the size range 45 to 55 cm seen in 1993 does not occur in 1994.

4.5.1.2 West of Ireland whiting, Divisions VIIb,c

Landings

Official landings statistics (Table 2.1.2) indicate that, in 1994, total international landings (excluding French landings) were 1179 t, with Ireland and the UK accounting for 88% and 12% respectively. Irish landings have increased steadily over the last five years. The 1995 TAC for VII (excluding VIIa) is 25,000t.

Commercial catch-effort data

CPUE data are available for the French fleet (Table 4.5.2). CPUE has decreased steadily between 1988 and 1994 in the non-*Nephrops* trawl.

International length compositions

The 1994 international landings length composition for whiting were derived using the Irish length frequency and are shown in Table 4.5.4. Whiting discard data are unavailable due to low sampling intensity. The length frequency in 1994 is similar to that in 1993, although total numbers have increased in 1994.

Biological Parameters and Yield per Recruit

Due to lack of age data for 1994, it was not possible to update the fishing mortality estimation made last year using catch curve analysis. That analysis produced F levels around 1.0, which is consistent with F values calculated for whiting in adjacent areas.

4.5.1.3 West of Ireland sole, Divisions VIIb,c

Landings

Official landings statistics for Sole in Divisions VIIb,c are given in Table 2.1.4. The preliminary estimate of sole landed in 1993 is 62 t. Ireland accounted for 98% of these landings. The (precautionary) TAC for this stock is 75t in 1995.

Commercial catch-effort data

CPUE data for the French fleet are given in Table 4.5.2. However, this fleet is not considered to be representative of the fishery taking sole.

International length compositions

The 1994 international landings length composition for sole were derived using the Irish length frequencies and are shown in Table 4.5.5. Length composition data were not available for 1993 landings.

4.5.1.4 West of Ireland plaice, Divisions VIIb,c

Landings

In 1994, official landings of plaice in Divisions VIIb,c (Table 2.1.3) were 207 t. Ireland contributed 97% of this reported catch, as in 1993. Irish landings of plaice have been increasing since 1991. The TAC for this stock in 1995 is 300 t.

International length compositions

International landings length composition data for plaice in Divisions VIIb,c were derived using the Irish length frequency data and are given in Table 4.5.6. The length frequency pattern for 1994 landings is similar to that for 1993.

4.5.2 Stocks in the southwest of Ireland (ICES Divisions VIIh-k)

4.5.2.1 Southwest of Ireland cod, Divisions VIIh-k

Landings

Data supplied to the Working Group (Table 4.5.1) indicate that, in 1994, total international landings were 1364 t, with Ireland and France accounting for 42% and 35%, respectively. Overall, landings appear to have decreased over the same time series.

Landings in this section include Division VIIh data, which are also incorporated in the Celtic Sea cod assessment.

Commercial catch-effort data

Data supplied by France (Table 4.5.2) illustrate a decrease in CPUE level since 1993 for non-*Nephrops* trawlers in ICES Divisions VIIj,k, and this level is the lowest of the time series. CPUE of *Nephrops* trawlers within these Divisions has also decreased in 1994 compared to 1993.

International length compositions

Length frequency data for 1995 international landings were derived using the Irish length frequency distribution and are shown in Table 4.5.3. They were similar to the 1993 length frequency composition.

4.5.2.2 Southwest of Ireland whiting, Divisions VIIh-k

Landings

International landings of whiting for Divisions VIIh-k as reported to the Working Group are provided in Table 4.5.1 and were 2880 t in 1994. Ireland landed 80% of this total. These preliminary figures indicate a decrease relative to 1993 landings, but remain high compared to earlier years. Landings data include those in Division VII, which are also included in the Celtic Sea whiting assessment.

The TAC for all Sub Area VII (excluding VIIa) was 25,000t in 1995.

Commercial catch-effort data

CPUE data (Table 4.5.2) for Divisions VIIh-k were available for the French fleets and indicate a decrease in CPUE of both non-*Nephrops* and *Nephrops* trawlers in Division VIIj,k in 1994 compared to 1993 levels. The CPUE value in 1994 for non-*Nephrops* trawlers was the lowest in the time series (1988-1990).

International length compositions

The international length compositions for whiting were derived using the Irish length frequency data and are given in Table 4.5.4. Length compositions were similar in 1993 and 1994.

Biological Parameters and Yield per Recruit

Due to lack of age data for 1994, it was not possible to update the fishing mortality estimation made last year using catch curve analysis. That analysis produced F levels around 1.0, which is consistent with F values calculated for whiting in adjacent areas.

4.5.2.3 Southwest of Ireland sole, Divisions VIIh-k

Landings

Sole landings as reported to the Working Group are given in Table 4.5.1. Total international landings in 1994 amounted to 658 t and appear to have decreased since 1993. The TAC applies to Divisions VIIh-k and is 720 t in 1995.

International length compositions

The 1994 length composition for international sole landings was derived using the Irish length frequency data and is shown in Table 4.5.5. Length compositions were similar in 1993 and 1994.

4.5.2.4 Southwest of Ireland plaice, Divisions VIIh-k

Landings

Total international landings as used by the Working Group are shown in Table 4.5.1. Landings have remained relatively steady over the period (1988-1993), but show a decrease in 1994, to 696 t. The TAC for this stock in Divisions VIIh-k is 1350 t in 1995.

Commercial catch-effort data

Commercial CPUE data were provided by France (Table 4.5.2). However, this fleet is not considered to be representative of the fishery taking plaice.

International length compositions

Length frequencies for 1994 international landings were derived using the Irish length frequency data and are given in Table 4.5.6. Length compositions were similar in 1994 compared to 1993.

TABLE 4.5.1 ICES Divisions VIIh-k International Landing Statistics
*Preliminary, **Include ICES Division VIIg

COD Landings, Divisions VIIh-k

Country	1988	1989	1990	1991	1992	1993	1994*
Belgium**	102	229	86	51	81	136	115
Denmark	+	-	-	+	-	-	-
France	1960	2137	1313	603	1056	866	480
Ireland	868	857	1064	1413	872	435	573
Norway	-	13	20	-	-	-	-
UK (England and Wales)	104	128	191	189	278	153	na
UK (Isle of Man)	-	-	-	-	-	-	na
UK (N. Ireland)	-	-	2	-	-	-	na
UK (Scotland)	2	-	122	19	13	4	na
UK							196
Total	3036	3364	2798	2275	2300	1594	1364

WHITING Landings, Divisions VIIh-k

Country	1988	1989	1990	1991	1992	1993	1994*
Belgium**	19	39	67	43	47	75	50
Denmark	-	-	-	-	-	-	-
France	777	753	529	367	306	300	251
Germany, Fed. Rep.	-	-	+	-	14	-	na
Ireland	1771	1483	1304	1068	1455	2977	2307
UK (England and Wales)	109	116	47	103	168	211	na
UK (Isle of Man)	-	-	-	-	-	-	na
UK (N. Ireland)	-	-	-	-	-	-	na
UK (Scotland)	1	-	27	12	8	12	na
UK							272
Total	2677	2391	1974	1593	1998	3575	2880

** Includes 57t reported as VII.

SOLE Landings, Divisions VIIh-k

Country	1988	1989	1990	1991	1992	1993	1994*
Belgium**	254	252	353	358	312	317	338
France	53	84	66	55	43	44	35
Ireland	182	206	266	306	255	237	115
UK (England and Wales)	166	177	144	232	214	209	na
UK (Isle of Man)	-	-	-	-	-	-	na
UK (N.Ireland)	-	-	-	-	-	-	na
UK (Scotland)	-	-	-	-	3	5	na
UK							170
Total	655	719	829	951	827	812	658

** Includes VIIg

PLAICE Landings, Divisions VIIh-k

Country	1988	1989	1990	1991	1992	1993	1994*
Belgium**	245	403	301	252	246	344	197
Denmark	+	+	-	+	-	+	-
France	135	229	77	173	185	66	26
Ireland	369	454	338	478	477	383	217
UK (England and Wales)	433	73	88	287	261	218	na
UK (Isle of Man)	-	-	-	-	-	-	na
UK (N. Ireland)	-	-	-	-	+	-	na
UK (Scotland)	1	-	1	+	7	7	na
UK							256
Total	1183	1159	805	1190	1176	1018	696

Table 4.5.2 French CPUE Series for ICES Divisions VIIb,c and VIIj,k

COD French CPUE Series
(CPUE, kg/1000kw.hrs)

ICES Div.	Fleet	1988	1989	1990	1991	1992	1993	1994
VIIb,c	Trawl Non Nephrops	58.56	49.14	29.2	14.03	9.14	26.2	28.3
	Trawl Nephrops	30.31	37.13	17.33	29.29	4.22	10.31	9.1
	Gillnets	51.55	-	-	-	23.5	-	-
VIIj,k	Trawl Non Nephrops	35.24	22.72	16.43	5.26	6	5.1	3.27
	Trawl Nephrops	29.45	16.01	6.57	2.07	4.75	5.3	2.85
	Gillnets	-	13.53	-	-	-	-	-
	Longlines	-	16.01	2.41	-	-	-	-

WHITING French CPUE Series
(CPUE, kg/1000kw.hrs)

ICES Div.	Fleet	1988	1989	1990	1991	1992	1993	1994
VIIb,c	Trawl Non Nephrops	9.65	6.18	8.36	7.25	8.78	7.4	3.3
	Trawl Nephrops	19.29	3.71	24.24	6.72	5.47	-	9.1
	Gillnets	-	-	-	-	11.7	-	-
VIIj,k	Trawl Non Nephrops	13.75	14.85	10.82	8.59	5.66	6.56	3.77
	Trawl Nephrops	7.89	3.69	4.39	0.19	0.75	5.37	3.98
	Gillnets	-	-	-	-	-	-	-
	Longlines	-	38.64	15.4	-	-	-	-

SOLE French CPUE Series
(CPUE, kg/1000kw.hrs)

ICES Div.	Fleet	1988	1989	1990	1991	1992	1993	1994
VIIb,c	Trawl Non Nephrops	0.12	0.12	0.33	0.2	0.59	0.33	1.1
	Trawl Nephrops	2.76	3.71	1.24	-	-	-	-
	Gillnets	-	-	-	-	-	-	-
VIIj,k	Trawl Non Nephrops	0.07	0.1	0.06	0.05	0.03	0.05	-
	Trawl Nephrops	-	-	-	-	-	-	-
	Gillnets	-	-	-	-	-	-	-
	Longlines	-	-	-	-	-	-	-

PLAICE French CPUE Series
(CPUE, kg/1000kw.hrs)

ICES Div.	Fleet	1988	1989	1990	1991	1992	1993	1994
VIIb,c	Trawl Non Nephrops	1.03	0.65	1.6	1.14	0.69	0.76	-
	Trawl Nephrops	-	3.71	2.48	-	-	-	-
	Gillnets	-	-	-	-	-	-	-
VIIj,k	Trawl Non Nephrops	1.07	1	1.04	0.48	0.39	0.51	0.14
	Trawl Nephrops	2.73	1.11	1.06	0.19	0.31	0.41	0.65
	Gillnets	-	-	-	-	-	-	-
	Longlines	-	-	-	-	-	-	-

Table 4.5.3 International length composition (Hundreds) for COD in ICES Division VIIb,c and VIIj,k in 1994.

Length (cm)	Total No.	
	VIIb,c	VIIj,k
20	0	0
21	0	0
22	0	0
23	0	0
24	0	0
25	0	2
26	0	5
27	5	12
28	5	30
29	8	28
30	19	82
31	44	101
32	48	92
33	49	134
34	78	225
35	49	207
36	63	185
37	75	116
38	61	123
39	64	112
40	53	42
41	52	53
42	47	67
43	45	60
44	64	78
45	43	83
46	48	107
47	56	127
48	34	116
49	48	117
50	42	86
51	41	129
52	34	92
53	44	140
54	34	140
55	33	134
56	27	135
57	31	135
58	23	129
59	26	93
60	27	103
61	18	101
62	30	146
63	22	138
64	23	126
65	14	111
66	18	101
67	18	92
68	13	116
69	18	77

Length (cm)	Total No.	
	VIIb,c	VIIj,k
70	25	77
71	18	93
72	32	95
73	38	68
74	28	100
75	33	69
76	27	63
77	34	57
78	44	48
79	44	42
80	40	19
81	38	36
82	35	23
83	37	22
84	21	41
85	27	20
86	33	31
87	15	13
88	12	15
89	16	16
90	9	15
91	4	5
92	4	14
93	9	5
94	7	13
95	11	2
96	7	12
97	4	2
98	4	2
99	3	5
100	5	5
101	1	0
102	0	2
103	1	4
104	0	0
105	0	0
106	1	0
107	0	0
108	0	0
109	0	0
110	0	0
111	0	0
112	0	0
113	0	0
114	0	0
115	0	2
116	0	0
Total No.	2263	5553
Landings*	622	1364

* As available to the working group (live weight, tonnes)

Table 4.5.4 International length composition (Hundreds) for WHITING in ICES Division VIIb,c and VIIj,k in 1994.

Length (cm)	Total No.	
	VIIb,c	VIIj,k
20	8	0
21	0	29
22	49	0
23	107	112
24	169	410
25	450	1076
26	1095	2355
27	1826	3988
28	2771	4807
29	3351	6421
30	4264	8339
31	3887	8056
32	3476	7851
33	3160	7547
34	2727	5924
35	2210	5542
36	1851	4738
37	1662	3647
38	1078	2702
39	991	2160
40	754	1517
41	634	921
42	444	1016
43	380	940
44	275	755
45	261	497
46	163	361
47	139	353
48	67	180
49	137	247
50	97	88
51	58	350
52	39	154
53	32	177
54	39	189
55	15	191
56	0	132
57	0	81
58	17	64
59	0	12
60	0	1
61	0	4
62	0	62
63	0	13
64	0	12
65	0	0
66	0	12
67	0	0
68	0	0
69	0	0
70	0	0
Total No.	38681	84031
Landings*	1287	2880

* As available to the working group (live weight, tonnes)

Table 4.5.5 International length composition (Hundreds) for SOLE in ICES Division VIIb,c and VIIj,k in 1994.

Length (cm)	Total No.	
	VIIb,c	VIIj,k
20	3	41
21	3	28
22	4	413
23	8	566
24	17	1009
25	26	1150
26	31	1521
27	41	1618
28	50	1728
29	48	1533
30	70	1718
31	101	1828
32	179	1529
33	169	1194
34	177	1001
35	158	1003
36	128	850
37	109	600
38	84	283
39	63	404
40	54	250
41	39	155
42	32	72
43	19	141
44	14	73
45	11	16
46	8	30
47	2	1
48	0	14
49	0	0
50	0	0
Total No.	1648	20769
Landings*	67	658

* As available to the working group (live weight, tonnes)

Table 4.5.6 International length composition (Hundreds) for PLAICE in ICES Division VIIb,c and VIIj,k in 1994.

Length (cm)	Total No.	
	VIIb,c	VIIj,k
19	0	4
20	0	16
21	3	25
22	4	45
23	51	57
24	132	174
25	292	286
26	572	757
27	720	1200
28	886	1585
29	875	1927
30	738	1813
31	556	1573
32	487	1568
33	330	1418
34	242	1420
35	172	984
36	162	869
37	126	519
38	78	348
39	91	335
40	63	205
41	44	191
42	46	184
43	23	117
44	22	66
45	15	75
46	18	75
47	13	55
48	12	61
49	7	20
50	8	8
51	6	4
52	4	8
53	2	16
54	1	4
55	3	4
56	2	4
57	1	0
58	0	0
59	0	0
60	0	0
61	0	0
62	0	4
Total No.	6808	18025
Landings*	215	696

* As available to the working group (live weight, tonnes)

5. NORTHERN STOCK OF HAKE.

5.1 Landings

Nominal landings of hake (Northern and Southern stocks) by country and Division as officially reported to ICES are given in Table 2.1.5.

Total international landings in 1994, as estimated by the Working Group, were 51,260 t, including landings from Divisions IIIa, IVb,c, which are regarded as being taken from the northern stock (Table 5.1.1). These landings were close to the 1993 figure of 52,150 t (WG estimate, unrevised), but were a record low and were well below the agreed 1994 TAC of 60,000 t. They were, however, 14% larger than the status quo estimate of 45,000 t for 1994 in the predictions made by the Group last year (the stochastic predictions gave an intermediate value with a median of 48,600 t).

The 1994 landings estimates include 4,150 t of hake landed in the Brittany ports for which data by Division are missing (see section 1.4). However, there is little doubt that these are taken from the northern stock, and they represent only a small proportion of the total landings.

5.1.1 Discards

Discards in the French artisanal and coastal trawl fisheries were estimated using the same procedures as in previous years, i.e. on the basis of the length compositions obtained during surveys and from the commercial fisheries for each quarter and for the northern (north of 46°30 N) and southern parts of the Bay of Biscay. The 1994 estimate of discards is 2,905 t, a figure which is among the highest in the data series, even though it does not include the quantity that may have been taken by the artisanal fleets of the three Brittany ports. It is suspected, however, that an error was made in the estimation of discards for 1994 and, possibly, for 1993 (see section 5.1.7 below).

The total catch (landings+discards) data available to the Working Group are given in Table 5.1.9 (VPA summary)

5.1.2 Length compositions

Length compositions of the 1994 catches by fishery unit and quarter were provided by France, Ireland, Spain and the UK (England and Wales), which make the majority of the catches. Scotland also provided catch weights by fishery unit and quarter. Annual catch figures were provided by all other countries and, in most instances, were taken from the official statistics.

The procedures used to derive the length compositions of the international catches are outlined in Table 5.1.2. Data were worked up quarterly whenever relevant samples were available. As usual, the discards data for the French fisheries in units 9, 10 and 15 were not extended to any other country.

As last year, the length compositions for fishery unit 15 (miscellaneous fisheries) were not raised to include catches by countries not providing samples for this unit; these were added directly to the annual grand total.

In previous years, length compositions for unit 16 (fisheries to the north of Sub-areas VII and VIII) were essentially derived from data provided by Spain and France. The French data came predominantly from the deep-sea trawlers of Lorient and Concarneau fishing to the west of the British Isles. Since no data were available for these vessels in 1994, the French samples for unit 16 are based on a fleet which is a small component of the fishery. Therefore, the available length compositions for that unit are not consistent with those used in previous years. Unfortunately, this unit usually provides most of the data for large hake, and it can be seen by comparing Table 5.1.3 with its equivalent in earlier reports that large fish are poorly represented in 1994. In spite of this, it has been decided to raise the combined French+Spanish samples in each quarter to include the landings by other countries which have reported catches by quarter (namely England+Wales, Ireland and Scotland). However, for other countries which are assumed to fish in unit 16 and only provided annual landings figures, it was deemed preferable to raise the length composition (landings only) obtained across all units and quarters. This is a departure from procedures used previously, but it is recalled that, due to the lack of appropriate information, the composition that should be applied to the landings of these "other" countries has always been a problem. Nevertheless, these landings are a small fraction of the total.

Since the landings into the Brittany ports (labeled unit X in Table 5.1.1) could not be broken down by fishery unit, the total annual length composition of the landings was raised to include them.

The length compositions of catches by fishery unit in 1994 are given in Table 5.1.3.

5.1.3 CPUE and survey data

Annual catch, effort and length composition data were available for the same set of fleets considered last year for tuning the VPA, namely: for Spain, trawlers from Vigo, trawlers and long liners from La Coruna, all fishing in Subarea VII, "bou" trawlers from Pasajes fishing in Divisions VIIIa,b and, for France, artisanal trawlers from Lesconil, Les Sables d'Olonne and La Rochelle fishing in the Bay of Biscay. Length compositions for these French fleets include estimates

of discards. In addition, catch and effort data are available from the RESSGASC quarterly surveys, but only the annual indices summed over all quarters are considered for the tuning. Survey data prior to 1987 were again excluded, since a different vessel was used then.

An examination of last year's assessment indicated that cpue data for some of these fleets were quite noisy, particularly the long line data. It was therefore decided for this meeting, that only a restricted set of fleets should be used.

5.1.4 Age compositions

As in recent years, quarterly ALKs were available from France for 1994, essentially based on fish sampled during the Ressgasc surveys. However, since very few fish larger than 50 cm are caught during the surveys, there is a serious lack of ageing material for old fish, even when the data are pooled into an annual ALK, and some interpolation is required to fill the gaps.

The annual ALK was applied to the annual length composition of the international catches obtained as indicated above to estimate the catch-at-age composition and mean weights at age in the catch for 1994. The catch-at-age matrix input to VPA is given in Table 5.1.4, and the mean weights at age in the catch (also used as mean weights in the stock) in Table 5.1.5. The small SoP discrepancies may be due to countries contributing data using their own set of parameters for the length/weight relationship, sometimes with different values for each quarter, whereas a single set of parameters is used to estimate mean weights at age when the ALK is applied.

The annual ALK was also applied to the length compositions of the catches by the fleets retained for tuning, to derive the CPUEs at age for 1994. The catch-at-age and effort data used for VPA tuning are given in Table 5.1.6.

5.1.5 Recruitment

Fishery-independent information on year-class strength is available from three surveys.

The UK March survey in the Celtic Sea provides indices for age-1 fish (based on, fish under 24 cm). The results indicate that the 1985, 1990 and 1992 year-classes were strong and of similar size in the Celtic Sea, whereas the 1991 year-class was poor. The 1993 and 1994 year-classes are relatively strong (Figure 5.1.1).

The French RESSGASC surveys are carried out quarterly in the Bay of Biscay. Indices for 0-group were defined, based on fish less than 13 cm in the second quarter and less than 16 cm in the third quarter, for the areas north and south of 46°30 N respectively. Plots of these indices since 1987 (Figure 5.1.2.) confirm the weakness of the 1992 year-class in the Bay of Biscay, which is the main traditional nursery area. The 1993 and 1994 year-classes are indicated to be of similar size as the 1987-1988 or 1990-1991 year-classes, according to the results from the third quarter which are more representative than those for the second quarter. For this reason, the results for the 1995 year-class in the second quarter must be regarded as preliminary (the third quarter survey was not completed at the time of this meeting). Although the index for this year-class is lower than that for the previous two, it is not expected to be particularly weak.
Data are also available from the French EVHOE surveys that were carried out in some years in the Celtic Sea and Bay of Biscay. Indices for age 0 (considered to be fish smaller than 19 cm) from the autumn surveys in the Bay of Biscay are plotted in Figure 5.1.3. As mentioned in previous reports, the number of recruits caught during the 1992 survey was very low on the main nursery area in the Bay of Biscay, but larger than usual in the Celtic Sea. Charts from the 1994 survey indicate that the pattern of distribution of recruits had returned to normal in the Bay of Biscay. The index for the 1994 year-class is 34% larger than that for the good 1990 year-class (but with a large variance), and this is consistent with the RESSGASC indices for the third quarter (both surveys only disagree about the 1987 year-class). Unfortunately, the coverage of the Celtic Sea was incomplete in 1994.

5.1.6 Estimation of fishing mortality.

Problems with this assessment.

Trial assessments of this stock revealed serious discrepancies that could be traced back to the length and age compositions estimated for 1994.

- An examination of the age compositions given in Table 5.1.4 shows that the estimate for catches of age 0 is much smaller than usual. In contrast, the estimate for age 2 is abnormally large, given that it corresponds to the 1992 year-class which the surveys and previous assessments indicated to be quite weak in the Bay of Biscay. The estimated catch of 52.7 million age 2 fish in 1994 includes 15.7 million discarded fish, which in itself is much larger than previous estimates for that age and also corresponds to a discarding ratio which is about twice the recent mean for age 2.

- Looking at the tuning data (Table 5.1.6), it can be seen that large catches at age 2 only appear in the data for the French fleets (which include discards), whereas the data for the Spanish fleets are consistent with a weak 1992 year-class. The main reason for concern is

that the anomaly also occurs in the data for the Ressgasc surveys from which all estimates of discards are derived, and it was already pointed out in section 5.1.2 that the estimated weight of discards for 1994 was on the high side of the observed range. A close inspection of the survey data has confirmed that there has effectively been an exceptionally large number of hake of 20-30 cm caught in the north of Bay of Biscay in the second and third quarters. This is precisely the area where the artisanal fleets of Brittany (unit 9 in particular) fish, and the lack of data for these fleets is one reason why the recorded length compositions from the commercial fleets may not show the phenomenon noted in the surveys.

- By comparison with data for previous years, Table 5.1.3 confirms that the problem essentially lies in the estimated length compositions for discards (age 2 lies roughly in the range 22-32 cm), and notably for fishery unit 10, but the length composition of landings for that unit also shows large numbers in that range. The scarcity of age 0 fish in the area where this fishery takes place is confirmed by recent surveys. However, due to difficulties in obtaining the French landings data, there has been insufficient time to check the full procedure of discards estimation for this meeting.

- Concerning young ages, at which fish grow significantly within the year, the problem of estimating numbers at age is further exacerbated when an annual ALK is applied to these length compositions, as small changes of the proportions at the margins of the distribution may mean a swap of large numbers of fish between adjacent ages. However, due to the sparse data for large fish, improving the precision for young ages, by using quarterly ALKs, would be at the expense of greater uncertainties for old fish and eventually for SSB estimates.

For illustration, a VPA was run using the available data, and tuned with XSA using the same options as used in previous year. The results are given in Tables 5.1.7-9 (tuning diagnostics in ICES stock files). As could be expected, the estimated F at age 2 in 1994 comes out as the highest value for that age in the last decade, although shrinkage contributed to reduce it towards the lower recent mean. Since age 2 is included in the standard range (1-4) for mean F, the latter seems to indicate a sudden increase of fishing mortality in 1994, the magnitude of which is not supported by information from the fishery. In addition, according to this VPA, the 1992 year-class appears stronger at age 0 than the adjacent classes, in contradiction with the information given above.

If we define status quo F according to the standard procedures for catch predictions, i.e. taking the mean exploitation pattern in the last three years scaled to mean F in the terminal year, the anomaly translates into fairly large Fs at age. For the intermediate year 1995, these result in predicted landings of about 58,000 t. Not only does this exceed the TAC, which has not happened for years, but such a figure is very unlikely in view of the landings recorded in the recent past. According to last year's assessment, this would require a 50% increase of fishing mortality compared to 1993. If a large catch is assumed in 1995, maintaining the same high F results in a steep decline of catches and SSB in subsequent years.

If the exploitation pattern is not scaled to mean F in 1994, the landings predicted for 1995 fall to about 48,000 t. This is probably closer to reality and consistent with the medium-term predictions presented last year. However, taking into account that all predictions for 1996 and in the medium-term would be highly dependent on the definition of the reference F and on the assumptions for 1995, the 10,000 t difference in the 1995 landings depending on whether scaling is applied is too large to be overlooked.

NB: the figures of predicted landings given above are the medians of Monte Carlo replicates using ADAPT for VPA tuning. No shrinkage is implemented in this method, and this may exaggerate the apparent increase of F at age 2 and the effect of scaling. However, a conventional assessment would probably show a similar discrepancy compared to last year's results.

Considering the serious consequences of a possible error in the data, and taking account of the other problems with the 1994 landings data, the Group decided to disregard this assessment until the length compositions (of discards, notably) are thoroughly checked. A particular procedure may also have to be explored to improve the separation between age 2 and adjacent ages in the application of length to age conversion procedure.

If this is feasible in time for the ACFM meeting, a revised assessment will be presented as a working document to ACFM. Otherwise, it is suggested that ACFM may base its advice on the medium-term predictions presented last year. For a status quo F option, the landings predicted for 1995 and 1996 were 46,000 t and 44,000 t (median values) respectively, and SSB was indicated to continue to decline to 130,000 t in 1996 and 125,000 t in 1997. A 30% reduction of fishing mortality, as recommended by ACFM last year, would result in landings of 42,000 t in 1995 and 38,000 t in 1996 and would halt the decline of SSB (135,000 t in 1996 and 1997).

5.1.7 Management considerations

Even though the Group was not in a position to provide a reliable assessment, there is no reason to think that the state of this stock is any better than indicated last year. SSB has been decreasing in recent years, landings have not reached the TAC's, and the

catch still comprises a very high proportion of immature hake.

In relation to item c) of the terms of reference, the comments given in last year's report are considered to be still appropriate.

Table 5.1.1. HAKE Northern stock. Landings in tons by country, fishery unit and quarter for 1994.

	Country	Spain	France	UK (E+W)	Ireland	UK(Scot.)	Netherland	Belgium	Denmark offic land.	Sweden offic land	Norway offic land.	Total landings
	Q1	1792		43								1835
	Q2	2544		176								2720
Unit 1	Q3	2441		167								2608
	Q4	1997		116								2113
	Total	8774	0	503	0	0	0	0	0	0	0	9277
	Q1			0								0
	Q2			1								1
Unit 2	Q3			3								3
	Q4			0								0
	Total	0	0	4	0	0	0	0	0	0	0	4
	Q1		1	175								176
	Q2		39	405								444
Unit 3	Q3		17	296								313
	Q4		11	245								256
	Total	0	68	1121	0	0	0	0	0	0	0	1190
	Q1	2099	48	185	231	1						2564
	Q2	1755	159	343	450							2707
Unit 4	Q3	1241	88	432	226	6						1993
	Q4	1517	50	311	92	7						1978
	Total	6612	345	1271	999	15	0	0	0	0	0	9241
	Q1		30	17	54	8						109
	Q2		81	25	250	8						363
Unit 5	Q3		18	40	293	7						360
	Q4		4	29	109	8						151
	Total	0	133	111	706	32	0	0	0	0	0	982
	Q1			14								14
	Q2			21								21
Unit 6	Q3			24								24
	Q4			15								15
	Total	0	0	74	0	0	0	0	0	0	0	74
	Q1		41									41
	Q2		83			0						84
Unit 7+8	Q3		95			0						95
	Q4		41			1						41
	Total	0	260	0	0	1	0	0	0	0	0	261
	Q1		159									159
	Q2		393									393
Unit 9	Q3		298									298
	Q4		155									155
	Total	0	1005	0	0	0	0	0	0	0	0	1005
	Q1		1075									1075
	Q2		2078									2078
Unit 10	Q3		1189									1189
	Q4		971									971
	Total	0	5314	0	0	0	0	0	0	0	0	5314
	Q1	764										764
	Q2	1203										1203
Unit 12	Q3	856										856
	Q4	452										452
	Total	3275	0	0	0	0	0	0	0	0	0	3275
	Q1		22									22
	Q2		40									40
Unit 13	Q3		27									27
	Q4		35									35
	Total	0	125	0	0	0	0	0	0	0	0	125
	Q1	1812										1812
	Q2	2232										2232
Unit 14	Q3	1980										1980
	Q4	1628										1628
	Total	7652	0	0	0	0	0	0	0	0	0	7652
	Q1		1130									1130
	Q2		1102			10						1112
Unit 15	Q3		435			8						443
	Q4		564			2						566
	Total	0	3231	0	0	20	0	37	0	0	0	3288
	Q1	111	107	97	32	148						495
	Q2	121	145	175	161	429						1031
Unit 16	Q3	191	18	187	22	348						766
	Q4	98	7	84	12	223						424
	Total	521	277	543	227	1148	75	52	2127	149	304	5423
	Q1		312									312
	Q2		982									982
Unit X	Q3		1222									1222
	Q4		1631									1631
	Total	0	4149	0	0	0	0	0	0	0	0	4149
	Q1	6578	2925	531	317	157	0	0	0	0	0	10509
	Q2	7855	5104	1147	860	447	0	0	0	0	0	15412
Total	Q3	6709	3408	1149	541	370	0	0	0	0	0	12178
	Q4	5692	3470	800	213	241	0	0	0	0	0	10416
	Total	26834	14907	3627	1932	1215	75	89	2127	149	304	51259

Table 5.1.2 . HAKE Northern stock. Derivations of quarterly length compositions of landings by country and fishery unit for 1994.

Country		France	Ireland	Spain	UKe+w	UKscot	Others
Unit	Quarter						
	1			SP1.Q1	SP1.Q1		
1	2			2	2		
	3			3	3		
	4			4	4		
	1				All.Year		
2	2				"		
	3				"		
	4				"		
	1	FR3.Q1			EW3.Q1		
3	2	EW3.Q2			2		
	3	FR3.Q3			3		
	4	4			4		
	1	FR4.Q1	IR4.Q1	SP4.Q1	FR+IR+SP	FR+IR+SP	
4	2	2	2	2	2	2	
	3	3	3	3	3	3	
	4	4	4	4	4	4	
	1	FR5.Q1	FR+EW.Q1		EW5.Q1	FR+EW.Q1	
5	2	2	2		2	2	
	3	3	3		3	3	
	4	4	4		4	4	
	1				EW6.Q1		
6	2				2		
	3				3		
	4				4		
	1	FR8.Q1					
7+8	2	2					
	3	3					
	4	4				FR8.Q4	
	1	FR9.Q1					
9	2	2					
	3	3					
	4	4					
	1	FR10.Q1					
10	2	2					
	3	3					
	4	4					
	1			SP12.Q1			
12	2			2			
	3			3			
	4			4			
	1	FR13.Q1					
13	2	2					
	3	3					
	4	4					
	1			SP14.Q1			
14	2			2			
	3			3			
	4			4			
	1	FR15.Q1				All.Year	All.Year
15	2	2				"	"
	3	3				"	"
	4	4				"	"
	1	FR16.Q1	SP+FR.Q1	SP16.Q1	SP+FR.Q1	SP+FR.Q1	All.Year
16	2	2	2	2	2	2	"
	3	3	3	3	3	3	"
	4	4	4	4	4	4	"
	1	All.Year					
X	2	"					
	3	"					
	4	"					
ALK	All	FR.Year	FR.Year	FR.Year	FR.Year	FR.Year	FR.Year

Table 5.1.3 Annual length compositions of landings, discards and catches by fishery unit for 1994

UNIT	1	3	4	5	6	7	9	10	12	13	14	15	16	LANDINGS ALL	Raised LANDINGS ALL	Discards 9	Discards 10	Discards 15	Discards ALL	CATCHES ALL
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	9	16	16
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	0	55	94	94
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	88	6	93	187	187
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	177	0	158	335	335
9	0	0	0	0	0	0	0	0	0	0	0-	0	0	0	0	217	6	160	384	384
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	221	5	148	373	373
11	0	0	0	0	0	0	0	0	0	0	76	0	0	76	89	162	11	97	271	360
12	0	0	0	0	0	0	0	0	0	0	166	0	0	166	193	114	32	70	216	409
13	0	0	0	0	0	0	0	0	0	0	258	0	0	258	301	114	158	88	360	661
14	0	0	0	0	0	0	0	0	0	0	271	0	0	271	315	94	306	117	516	832
15	0	0	0	0	0	0	0	0	0	0	976	0	0	977	1138	122	347	168	637	1775
16	0	0	397	0	0	0	0	0	0	0	1133	0	0	1530	1783	191	545	264	999	2782
17	0	0	1054	0	0	0	0	0	0	0	1803	0	0	2857	3330	280	827	383	1491	4821
18	0	0	2437	0	0	0	9	0	0	0	2772	0	0	5218	6081	365	1023	475	1863	7944
19	0	0	4074	0	0	0	27	0	0	0	3184	6	1	7291	8498	465	1267	651	2383	10881
20	0	0	3948	0	0	0	46	0	0	0	4603	29	1	8627	10054	558	1813	829	3199	13253
21	0	0	2410	0	0	0	138	0	0	0	3963	60	1	6571	7658	542	2079	1001	3623	11281
22	0	0	1757	0	0	1	319	21	0	0	2957	131	1	5187	6045	482	2061	1183	3727	9772
23	0	0	1220	0	0	2	531	57	0	0	1911	237	2	3961	4617	330	2194	1266	3790	8407
24	0	0	898	1	0	11	604	250	0	0	1966	328	4	4061	4732	241	1841	1103	3185	7918
25	0	0	422	3	0	16	649	380	0	1	1591	371	9	3444	4014	114	1658	903	2676	6690
26	0	1	297	10	0	19	578	676	0	2	978	459	26	3045	3548	139	1157	848	2145	5693
27	0	1	120	15	0	31	530	1059	0	3	864	522	35	3178	3704	103	705	699	1506	5210
28	0	1	161	20	0	33	439	1217	3	2	705	378	45	3003	3500	88	642	467	1198	4698
29	0	1	221	22	0	30	432	1115	1	3	589	374	45	2833	3301	10	223	291	525	3826
30	0	1	353	34	2	33	351	1178	2	4	498	282	61	2797	3260	0	132	204	336	3596
31	0	1	420	47	2	29	351	1186	8	3	600	248	79	2975	3467	0	172	139	311	3778
32	0	2	487	75	4	39	219	1252	12	4	465	275	89	2925	3409	0	50	75	125	3534
33	5	2	540	80	7	38	154	1063	11	3	417	203	103	2623	3057	0	107	34	141	3198
34	0	2	564	92	9	29	121	814	25	3	514	149	97	2419	2819	0	102	40	142	2961
35	0	2	541	96	9	31	122	820	24	3	486	151	90	2374	2768	0	59	16	75	2842
36	0	2	409	64	10	20	75	497	45	3	536	157	61	1881	2192	0	15	6	21	2213
37	3	2	439	73	10	20	72	493	65	4	441	120	55	1795	2092	0	0	1	1	2[redacted]
38	4	2	474	67	9	16	55	445	72	4	621	145	64	1978	2305	0	0	0	0	23[redacted]
39	16	2	480	62	7	11	47	364	84	4	575	135	54	1841	2146	0	0	0	0	2146
40	17	2	581	71	8	13	40	401	121	4	512	145	62	1975	2302	0	0	0	0	2302
41	42	3	576	48	6	11	26	344	112	5	510	127	50	1859	2167	0	0	0	0	2167
42	36	2	556	54	5	9	25	274	125	4	518	95	50	1753	2043	0	0	0	0	2043
43	87	2	599	45	4	9	17	256	128	3	514	120	48	1830	2133	0	0	0	0	2133
44	61	2	508	43	4	11	16	261	111	4	443	92	46	1601	1866	0	0	0	0	1866
45	68	3	481	40	3	11	9	232	146	4	460	89	53	1597	1861	0	0	0	0	1861
46	94	2	399	46	3	9	9	204	118	3	419	84	62	1453	1693	0	0	0	0	1693
47	137	2	415	37	2	6	3	145	157	3	402	77	54	1440	1678	0	0	0	0	1678
48	129	2	324	29	1	3	2	95	97	3	288	70	53	1097	1278	0	0	0	0	1278
49	201	2	301	36	2	3	4	77	117	2	203	42	53	1043	1215	0	0	0	0	1215
50	254	2	269	30	2	3	6	77	142	2	166	36	60	1049	1222	0	0	0	0	1222
51	194	2	235	18	1	2	1	49	133	2	108	24	47	815	950	0	0	0	0	950
52	242	2	181	14	1	5	4	52	85	1	95	20	43	744	867	0	0	0	0	867
53	197	2	171	11	1	3	1	36	85	1	68	17	39	631	736	0	0	0	0	736
54	270	4	168	8	1	2	0	35	81	1	52	18	51	690	804	0	0	0	0	804
55	240	2	135	9	1	1	1	35	64	1	48	20	50	604	704	0	0	0	0	704
56	244	2	124	10	1	4	3	50	72	2	47	31	45	635	740	0	0	0	0	740
57	310	3	106	8	1	5	1	45	72	1	38	29	52	670	781	0	0	0	0	781
58	256	4	100	8	1	2	0	36	97	1	36	38	62	640	746	0	0	0	0	746
59	275	2	76	8	0	2	0	36	78	1	33	43	46	602	701	0	0	0	0	701
60	289	5	83	10	1	2	2	37	79	1	34	44	56	645	751	0	0	0	0	751
61	219	6	78	7	1	3	1	32	98	1	26	64	57	591	689	0	0	0	0	689
62	255	6	76	7	0	2	1	29	62	1	32	61	53	585	682	0	0	0	0	682
63	265	7	67	7	0	3	0	25	55	1	25	49	36	540	630	0	0	0	0	630
64	219	8	76	9	1	2	3	23	71	1	22	46	52	534	623	0	0	0	0	623
65	194	18	49	8	1	3	1	29	38	1	30	51	43	466	543	0	0	0	0	543
66	179	17	60	8	1	3	1	18	49	1	28	52	35	451	525	0	0	0	0	525
67	184	19	49	9	1	1	2	13	45	1	22	31	30	405	472	0	0	0	0	47[redacted]
68	158	20	46	10	0	2	1	21	33	1	18	47	34	393	458	0	0	0	0	4[redacted]
69	125	25	50	7	1	2	0	12	30	1	20	34	28	334	389	0	0	0	0	38[redacted]
70	127	31	35	9	1	1	0	14	20	1	10	30	32	310	361	0	0	0	0	361
71	97	21	32	6	0	1	0	9	14	1	8	26	16	232	270	0	0	0	0	270
72	101	32	31	5	1	1	1	5	20	0	10	23	23	254	296	0	0	0	0	296
73	82	21	22	6	0	1	0	8	12	1	8	22	10	173	202	0	0	0	0	202
74	65	28	22	4	0	1	0	5	12	0	6	14	11	168	196	0	0	0	0	196
75	42	16	18	5	0	1	0	5	7	0	2	11	5	112	131	0	0	0	0	131
76	27	22	12	3	0	0	0	3	3	0	3	8	9	92	107	0	0	0	0	107
77	24	14	12	3	0	1	0	3	5	0	1	7	8	77	90	0	0	0	0	90
78	18	13	12	2	0	1	0	2	3	0	1	7	4	63	73	0	0	0	0	73
79	10	8	8	1	0	0	0	2	2	0	1	3	4	40	47	0	0	0	0	47
80	11	11	6	2	0	1	0	3	2	0	0	5	5	44	51	0	0	0	0	51
81	6	8	5	2	0	0	0	1	2	0	0	4	3	32	38	0	0	0	0	38
82	6	6	2	1	0	1	0	1	2	0	0	4	1	26	30	0	0	0	0	30
83	6	6	4	0	0	0	0	1	1	0	0	6	1	27	32	0	0	0	0	32
84	4	5	1	2	0	0	0	0	1	0	0	1	1	17	19	0	0	0	0	19
85	2	3	2	0	0	0	0	1	1	0	0	2	2	15	17	0	0	0	0	17
86	3	2	4	0	0	0	0	2	0	0	0	3	1	16	19	0	0	0	0	19
87	1	2	2	2	0	0	0	0	0	0	0	1	1	10	12	0	0	0	0	12
88	4	2	1	0	0	0	0	0	0	0	0	0	1	9	11	0	0	0	0	11
89	1	2	1	2	0	0	0	0	0	0	0	1	0	7	8	0	0	0	0	8
90	2	2	0	0	0	0	0	0	0	0	0	0	1	5	6	0	0	0	0	6
91	2	1	2	1	0	0	0	0	1	0	0	1	0	8	9	0	0	0	0	9
92	1	1	2	0	0	0	0	0	0	0	0	1	0	6	7	0	0	0	0	7
93	1	1	1	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	4
94	1	2	0	0	0	0	0	0	0	0	0	1	0	4	4	0	0	0	0	4
95	0	1	0	1	0	0	0	0	0	0	0	1	0	3	4	0	0	0	0	4
96	1	1	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	2
97	1	1	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	3
98	1	1	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	2
99	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	2
100	1	3	1	1	0	0	0	1	0	0	0	1	2	11	13	0	0	0	0	13
Total N *1000	6100	466	31295	1475	123	555	6048	15932	3160	108	41185	6640	2516	115603	134730	5261	19544	12045	36850	171580
Catch tonnes	9276	1189	9242	983	74	261	1005	5313	3275	84	7652	3231	2397	43982	51259	275	1610	1020	2905	54164

Table 5.1.4

Run title : Hake, Northern Area (run: FINVPA95/OUT)

At 6-Sep-95 16:09:43

Table 1 Catch numbers at age Numbers*10**-3 YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE							
0,	9659,	11350,	24696,	12717,	12294,	11930,	12063,
1,	74531,	71921,	70466,	79435,	82207,	79869,	48444,
2,	32081,	31411,	27637,	31149,	74081,	28572,	14037,
3,	16391,	13228,	15275,	14699,	14067,	23077,	14971,
4,	8279,	7125,	12592,	10060,	10031,	15823,	18114,
5,	8402,	6765,	9150,	8705,	5634,	7574,	9158,
6,	5297,	4984,	4208,	4174,	4264,	5083,	7799,
7,	2310,	3642,	3114,	3896,	2648,	2891,	3993,
8,	1589,	2739,	2554,	2918,	2084,	2057,	2756,
9,	636,	1217,	1332,	1004,	907,	956,	1188,
+gp,	2811,	2455,	2997,	3338,	2823,	3072,	3412,
TOTALNUM,	161986,	156837,	174021,	172095,	211040,	180904,	135935,
TONSLAND,	52908,	53799,	60459,	56264,	58057,	60128,	65149,
SOPCOF %,	102,	102,	102,	93,	103,	100,	101,

Table 1 Catch numbers at age Numbers*10**-3 YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
0,	163158,	16287,	13943,	41079,	8074,	40880,	23983,	17650,	42922,	5122,
1,	54806,	81912,	34348,	32174,	46330,	37266,	66156,	41109,	51377,	57764,
2,	10528,	20250,	23731,	18401,	24882,	38663,	15320,	21999,	21503,	52766,
3,	10958,	19792,	13062,	22497,	21199,	20467,	24085,	19731,	16634,	22002,
4,	5944,	7815,	16132,	10515,	14153,	11141,	10312,	16909,	9132,	12889,
5,	4969,	4676,	9187,	9515,	9556,	8343,	7281,	10272,	5588,	8267,
6,	5597,	3832,	5807,	7883,	6837,	6158,	5715,	6461,	5763,	3771,
7,	4151,	2704,	3421,	6498,	3914,	4747,	4662,	4215,	6012,	4508,
8,	4490,	2362,	2867,	3826,	3533,	3643,	3728,	3267,	2885,	1883,
9,	2088,	1498,	1152,	1529,	2157,	1315,	1726,	1882,	1931,	1936,
+gp,	4368,	5639,	4878,	2651,	3605,	2371,	2706,	1412,	1281,	674,
TOTALNUM,	271057,	166767,	128528,	156568,	144240,	174994,	165674,	144907,	165028,	171582,
TONSLAND,	63644,	60053,	65320,	66818,	68781,	61410,	59286,	58290,	53637,	54164,
SOPCOF %,	100,	100,	100,	100,	99,	101,	98,	100,	100,	101,

Table 5.1.5

Run title : Hake, Northern Area (run: FINVPA95/OUT)

At 6-Sep-95 16:09:43

Table 2 Catch weights at age (kg)

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE							
0,	.0160,	.0160,	.0210,	.0150,	.0130,	.0140,	.0140,
1,	.0550,	.0540,	.0640,	.0570,	.0470,	.0510,	.0510,
2,	.1750,	.1770,	.1770,	.1720,	.1480,	.1670,	.1810,
3,	.3560,	.3540,	.3570,	.3580,	.3600,	.3400,	.3370,
4,	.5690,	.5700,	.5700,	.5700,	.5600,	.5620,	.5660,
5,	.8350,	.8340,	.8300,	.8290,	.8400,	.8380,	.8430,
6,	1.1510,	1.1530,	1.1560,	1.1550,	1.1500,	1.1520,	1.1490,
7,	1.5130,	1.5170,	1.5160,	1.5190,	1.5170,	1.5140,	1.5160,
8,	1.9220,	1.9170,	1.9170,	1.9130,	1.9180,	1.9200,	1.9180,
9,	2.3160,	2.3260,	2.3300,	2.3250,	2.3220,	2.3230,	2.3240,
+gp,	3.7270,	3.8500,	3.7960,	3.9900,	3.8090,	3.8050,	3.8800,
SOPCOFAC,	1.0170,	1.0186,	1.0229,	.9336,	1.0334,	.9990,	1.0101,

Table 2 Catch weights at age (kg)

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,
AGE										
0,	.0300,	.0080,	.0130,	.0210,	.0140,	.0150,	.0240,	.0310,	.0230,	.0170,
1,	.0660,	.0580,	.0530,	.0680,	.0750,	.0540,	.0590,	.0490,	.0590,	.0550,
2,	.1920,	.1970,	.1800,	.1660,	.1910,	.1510,	.1660,	.1440,	.1370,	.1270,
3,	.3620,	.3460,	.3530,	.3360,	.3470,	.3370,	.3300,	.3010,	.3310,	.3020,
4,	.5620,	.5650,	.5650,	.5640,	.5670,	.5450,	.5690,	.5240,	.5700,	.5540,
5,	.8350,	.8370,	.8360,	.8350,	.8390,	.8240,	.8090,	.7970,	.8690,	.8450,
6,	1.1460,	1.1550,	1.1550,	1.1560,	1.1520,	1.1400,	1.1720,	1.1500,	1.1270,	1.1720,
7,	1.5140,	1.5100,	1.5120,	1.5120,	1.5190,	1.5040,	1.4900,	1.5190,	1.5950,	1.6440,
8,	1.9260,	1.9240,	1.9260,	1.9220,	1.9180,	1.9200,	1.9100,	1.8770,	1.9710,	2.1510,
9,	2.3110,	2.3230,	2.3170,	2.3330,	2.3290,	2.3250,	2.3110,	2.4190,	2.4600,	2.3810,
+gp,	3.4800,	3.4530,	3.6580,	3.6190,	3.3210,	3.3770,	3.3110,	3.3930,	3.6540,	3.8350,
SOPCOFAC,	1.0044,	1.0000,	.9958,	.9974,	.9920,	1.0146,	.9809,	1.0046,	.9982,	1.0065,

Table 5.1.6. Hake Northern Stock. CPUE data used for tuning.

FLEET DATA FOR LS & XSA TUNING N.HAKE- Rev 24 Aug. 95
105 ! Selected Fleets or Years
CORUTR7(2-10)
1985 1994
1 1 0. 1.
2 10

14268	89.9	383.6	825.7	800	887.3	675.2	494.7	185.3	285.8	1985
11604	1313.2	2380.8	741.4	433.7	336.1	217.3	200.3	109.8	295	1986
12444	1153.7	2559.9	3957	2095.4	934.2	328.1	199	69.1	234.6	1987
12852	547.4	1606.6	1490.3	1530.5	1105.8	652.9	307.4	95.7	101.9	1988
12420	159.4	1149.5	1525.6	1430.9	1023.4	459.1	332.9	175.3	183.3	1989
11328	159.6	725.9	1343.2	937.3	732.8	364.6	228	81.1	128.5	1990
9852	254.4	1221.1	1193.9	688.7	367.3	232.6	129.6	72.5	106.8	1991
6828	67.4	1336.8	2218	1211.5	379.5	147.2	90.6	44.1	31	1992
5748	58.7	740.9	779	589.4	555.9	303.6	96	37.9	14.5	1993
5736	41.3	850.9	1599.9	1013.4	365	245.4	70.3	59.7	14.4	1994

PASAJES8(2-10)
1986 1994
1 1 0. 1.
2 10

46719	500.3	714.4	574.1	514.8	331.9	180.8	121.8	51.2	71.5	1986
50664	617.1	706.7	1343.8	907.4	449.9	231.2	146.4	38.3	68.2	1987
42160	568.5	1246.9	696.2	690.4	469	241.4	104.5	39.5	27.5	1988
47193	806.3	1153.2	1275.3	817.3	342.3	138	95.7	30.4	19.3	1989
50776	1300.8	601.6	936.7	752.2	514.5	273.1	150.8	38.4	32.1	1990
47844	862.1	704.9	684.7	518.1	315.2	226.6	167.1	78.8	76.9	1991
56228	750.7	1407.4	1116.2	532.8	249.8	142.2	99.6	42.8	18.6	1992
55195	522.9	1620.1	1468.7	611.3	319.9	175.5	77.3	45.1	19.9	1993
42228	203.2	1052.7	1686.4	934.4	203.9	130.7	48.9	46	7	1994

LESCONIL(0-5)
1978 1994
1 1 0. 1.
0 5

8447	1146.8	4833.1	369.6	117.5	36.2	17.5	11.5	8.7	7	2.6	4.5	1978
7533	1203.2	4870.3	380.8	111.8	37.3	16.7	10.8	9.7	7.2	3.4	3.7	1979
7751	1909.1	3482.7	273.7	99.2	40.2	16.5	9.6	9.5	7.3	3.4	3.9	1980
6975	871	3526	285.5	79.9	30.1	13.9	9	7.5	5.3	2.8	4.1	1981
6729	770.7	3869.5	879.7	72.7	36.1	11.7	11	9.3	7.3	3	4.2	1982
6481	945.9	4554.3	377.3	132.3	46.8	14	11	9.3	7	3	4.2	1983
5673	965.2	4225.2	312.7	108.5	55.3	13.1	11.6	9.1	7	3.1	4	1984
7952	11342.1	2897.7	311.8	417.9	108.1	28.8	27.1	13.1	7.2	2.6	0.6	1985
7318	1077	5096.5	269.6	188	49.1	21.4	18	8.6	5.1	2.2	1.4	1986
7180	1284.8	1841.9	396.6	153.3	54.5	9.6	5.4	4.5	4.1	1.5	2.7	1987
7140	866.1	634.4	326	324.9	93.1	59.8	17.2	7	1.5	0.1	0	1988
5932	210	1809.5	589.7	205.5	47.7	22	16.7	9.3	6.2	2.4	2.1	1989
5510	717	824.2	419.7	98.4	64.8	31.2	28.7	21.8	14.5	3.9	1.8	1990
5451	906.5	2303.2	341.7	93.4	44.1	20.1	14.6	14.8	11.2	6	6.5	1991
5746	663.1	1324.7	357.7	108.5	43.7	14.5	6.6	5.5	6.8	3.7	1	1992
5688	657.8	1565.6	720.6	186.4	33.2	8	4.1	1.9	2.2	1.5	0.7	1993
4836	433.4	1010.3	1527.7	282	34	6.7	2.1	2	0.5	1	0	1994

LesSABLES(0-5)
1983 1994
1 1 0. 1.
0 5

9069	10.8	762.6	1336.2	753.2	235.5	48.5	35.4	26	18.5	10.1	15.1	1983
8349	231.4	779.3	788.9	276.4	136	31.4	31.9	30.1	19.1	3.5	7	1984
8923	20658.1	6908.5	832.9	287.4	79.7	32.1	16.2	17.5	29	13.5	31.1	1985
8770	4324	21465.3	1387	790.6	141.7	34	14.7	9.7	3	0.1	0	1986
8165	20.4	1039.4	1146.4	316.8	187	33.6	10.1	3.6	4.5	1.2	0.1	1987
9189	428.5	995.3	969.4	906.9	161.9	17	1.3	2	2.3	0.4	0	1988
9192	112	1958.2	1479.7	819.4	185.4	34.6	16.7	5.6	5	2.8	0.6	1989
9635	176.6	971.3	1664.6	493	122.7	30.2	14.2	10.2	5.5	0.8	0	1990
8274	53.5	1206.1	579.9	324.2	143.4	23.6	4.9	7.6	6	3.4	2.7	1991
8093	903.8	2112.9	697	174.6	49.7	22.7	14.5	6.4	2.7	0.3	0.3	1992
7329	55	370.5	411.1	234.7	48.2	8	3	1.4	0	0	0	1993
7293	45.6	576.1	1192.3	375.5	70.4	17	3.7	3.5	0.7	0.6	0	1994

RESSGASC(0-5)
1987 1994
1 1 0. 1.
0 5

18629	8386.3	14947.5	5123.2	950.8	391.5	139.8	81.5	44.8	37.3	14.5	39.8	1987
17920	7565.1	10721.2	4111.1	2531.1	537.7	184.8	86.9	73.7	28.2	10.8	24.5	1988
16972	1770	19389.4	5892.3	1996	545.4	229.3	128.7	69.1	39.7	17.1	31	1989
18774	4184.5	11192.8	10985.9	2137.5	470	219.4	117	91	72.3	30.7	49.2	199(
20260	3410.2	13495.1	3146.3	1993.3	267.7	105.1	58.6	31.9	27.8	17.2	27	199
17597	3409.4	7403.3	3263.2	1222.5	432	112	44.5	30	24.3	25.6	29.1	19(
20400	4994.2	8748.6	4454.4	1622.1	270.9	56.2	35.4	28.1	17.3	16.9	100	19
16415	2925.9	5878.7	10834	2803.1	452.5	104.1	25.2	27.1	11.1	12.9	6	1

Table 5.1.7

Run title : Hake, Northern Area (run: FINVPA95/OUT)

At 6-Sep-95 16:10:00

Table 8 Fishing mortality (F) at age YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE							
0,	.0346,	.0389,	.0631,	.0441,	.0448,	.0454,	.0471,
1,	.3788,	.3866,	.3577,	.2956,	.4397,	.4521,	.2617,
2,	.2722,	.2706,	.2504,	.2642,	.4973,	.2672,	.1309,
3,	.2616,	.1714,	.2041,	.2043,	.1824,	.2812,	.2182,
4,	.2015,	.1729,	.2452,	.2010,	.2095,	.3215,	.3730,
5,	.2858,	.2521,	.3510,	.2674,	.1652,	.2419,	.3121,
6,	.3018,	.2741,	.2457,	.2669,	.2026,	.2206,	.4220,
7,	.1953,	.3508,	.2752,	.3782,	.2706,	.2058,	.2703,
8,	.2361,	.3745,	.4461,	.4504,	.3572,	.3493,	.3093,
9,	.2454,	.2865,	.3145,	.3147,	.2434,	.2751,	.3495,
+gp,	.2454,	.2865,	.3145,	.3147,	.2434,	.2751,	.3495,
FBAR 1- 4,	.2785,	.2504,	.2643,	.2413,	.3322,	.3305,	.2459,
FBAR 4- 7,	.2461,	.2625,	.2793,	.2784,	.2120,	.2475,	.3443,

Table 8 Fishing mortality (F) at age YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	FBAR 92-94
AGE											
0,	.4255,	.0703,	.0583,	.1460,	.0384,	.1431,	.0931,	.0551,	.1805,	.0225,	.0861,
1,	.3115,	.3934,	.2077,	.1853,	.2441,	.2496,	.3626,	.2285,	.2250,	.3932,	.2822,
2,	.0827,	.1802,	.1870,	.1638,	.2136,	.3311,	.1536,	.1954,	.1791,	.3806,	.2517,
3,	.1431,	.2207,	.1691,	.2719,	.2882,	.2734,	.3547,	.3027,	.2223,	.2812,	.2687,
4,	.1258,	.1439,	.2822,	.1999,	.2746,	.2413,	.2150,	.4543,	.2229,	.2687,	.3153,
5,	.1642,	.1379,	.2513,	.2678,	.2818,	.2581,	.2457,	.3452,	.2641,	.3231,	.3108,
6,	.3194,	.1841,	.2540,	.3559,	.3140,	.2960,	.2829,	.3593,	.3319,	.2865,	.3259,
7,	.4174,	.2511,	.2489,	.5029,	.3001,	.3751,	.3834,	.3488,	.6760,	.4718,	.4989,
8,	.5555,	.4464,	.4616,	.4879,	.5691,	.5073,	.5738,	.5108,	.4292,	.4613,	.4671,
9,	.4086,	.3606,	.4082,	.4814,	.5675,	.4285,	.4819,	.6498,	.6563,	.5787,	.6282,
+gp,	.4086,	.3606,	.4082,	.4814,	.5675,	.4285,	.4819,	.6498,	.6563,	.5787,	
FBAR 1- 4,	.1658,	.2346,	.2115,	.2052,	.2551,	.2739,	.2715,	.2952,	.2123,	.3309,	
FBAR 4- 7,	.2567,	.1793,	.2591,	.3316,	.2926,	.2926,	.2817,	.3769,	.3737,	.3375,	

Table 5.1.8

Run title : Hake, Northern Area (run: FINVPA95/OUT)

At 6-Sep-95 16:10:00

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,
AGE							
0,	313479,	328881,	446247,	325941,	310016,	297156,	289774,
1,	261203,	247915,	258995,	343010,	255351,	242695,	232496,
2,	148788,	146416,	137899,	148287,	208957,	134680,	126434,
3,	78695,	92789,	91454,	87895,	93222,	104048,	84414,
4,	50131,	49599,	64000,	61055,	58662,	63596,	64307,
5,	37351,	33553,	34161,	41005,	40885,	38952,	37750,
6,	22470,	22978,	21350,	19690,	25696,	28376,	25038,
7,	14388,	13604,	14303,	13672,	12344,	17180,	18633,
8,	8351,	9690,	7843,	8893,	7668,	7710,	11450,
9,	3231,	5400,	5455,	4110,	4640,	4393,	4451,
+gp,	14197,	10823,	12190,	13571,	14361,	14028,	12690,
TOTAL,	952284,	961648,	1093896,	1067128,	1031802,	952813,	907435,

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	GMST 78-92	AMST 78-92
AGE													
0,	520305,	265214,	272162,	334103,	236622,	338808,	298208,	363689,	287256,	253938,	0,	323108,	329373,
1,	226331,	278358,	202401,	210211,	236371,	186424,	240403,	222451,	281793,	196348,	203284,	240583,	242974,
2,	146518,	135714,	153783,	134633,	142994,	151603,	118912,	136965,	144930,	184225,	108501,	143714,	144839,
3,	90814,	110432,	92790,	104434,	93578,	94560,	89138,	83494,	92232,	99202,	103106,	92441,	92784,
4,	55566,	64437,	72506,	64151,	65148,	57434,	58899,	51187,	50506,	60462,	61322,	59716,	60045,
5,	36260,	40115,	45685,	44766,	43008,	40532,	36942,	38892,	26609,	33088,	37846,	39178,	39324,
6,	22621,	25191,	28612,	29091,	28042,	26566,	25636,	23657,	22548,	16729,	19614,	24846,	25001,
7,	13442,	13456,	17157,	18171,	16685,	16772,	16178,	15818,	13523,	13246,	10287,	15336,	15454,
8,	11642,	7250,	8570,	10952,	8998,	10119,	9437,	9027,	9137,	5632,	6768,	9079,	9173,
9,	6880,	5469,	3798,	4423,	5504,	4170,	4988,	4353,	4435,	4870,	2908,	4676,	4751,
+gp,	14272,	20431,	15949,	7594,	9099,	7453,	7746,	3226,	2905,	1676,	3006,		
TOTAL,	1144652,	966066,	913415,	962530,	886049,	934441,	906487,	952760,	935874,	869416,	556643,		

Table 5.1.9

Run title : Hake, Northern Area (run: FINVPA95/OUT)

At 6-Sep-95 16:10:00

Table 16 Summary (without SOP correction)

	RECRUITS, Age 0	TOTALBIO,	TOTSPBIO,	CATCHES,	LANDINGS,	DISCARDS,	YIELD/SSB,	FBAR 1- 4,	FBAR 4- 7,
1978,	313478,	257225,	175704,	52908,	50553,	2355,	.3011,	.2785,	.2461,
1979,	328881,	253602,	169637,	53799,	51096,	2703,	.3171,	.2504,	.2625,
1980,	446247,	268220,	175298,	60459,	57266,	3193,	.3449,	.2643,	.2793,
1981,	325941,	274433,	182938,	56264,	53920,	2344,	.3076,	.2413,	.2784,
1982,	310016,	276170,	186797,	58057,	54996,	3061,	.3108,	.3322,	.2120,
1983,	297156,	279871,	196041,	60128,	57508,	2620,	.3067,	.3305,	.2475,
1984,	289774,	274023,	195579,	65149,	63288,	1861,	.3331,	.2459,	.3443,
1985,	520305,	287324,	187814,	63644,	56425,	7219,	.3389,	.1658,	.2567,
1986,	265214,	299809,	207465,	60053,	57093,	2960,	.2895,	.2346,	.1793,
1987,	272162,	296496,	209123,	65320,	63368,	1952,	.3124,	.2115,	.2591,
1988,	334104,	272266,	183376,	66818,	64824,	1994,	.3644,	.2052,	.3316,
1989,	236622,	271789,	180050,	68781,	66472,	2309,	.3820,	.2551,	.292
1990,	338808,	244411,	165972,	61410,	59880,	1530,	.3700,	.2739,	.2926,
1991,	298208,	243244,	163120,	59286,	57590,	1696,	.3635,	.2715,	.2817,
1992,	363689,	214499,	139422,	58290,	56618,	1672,	.4181,	.2952,	.3769,
1993,	287256,	212042,	131619,	53637,	52146,	1491,	.4075,	.2123,	.3737,
1994,	253938,	201448,	123673,	54164,	51259,	2905,	.4380,	.3309,	.3375,
Arith. Mean	322459,	260404,	174919,	59892,	57312,	2580,	.3474,	.2588,	.2854,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),	(Tonnes),	(Tonnes),			

Figure 5.1.1

Northern Hake. English Celtic Sea Groundfish indices from 1983-1995.
Yearclass indices derived by raising catch rates to the standard survey areas.

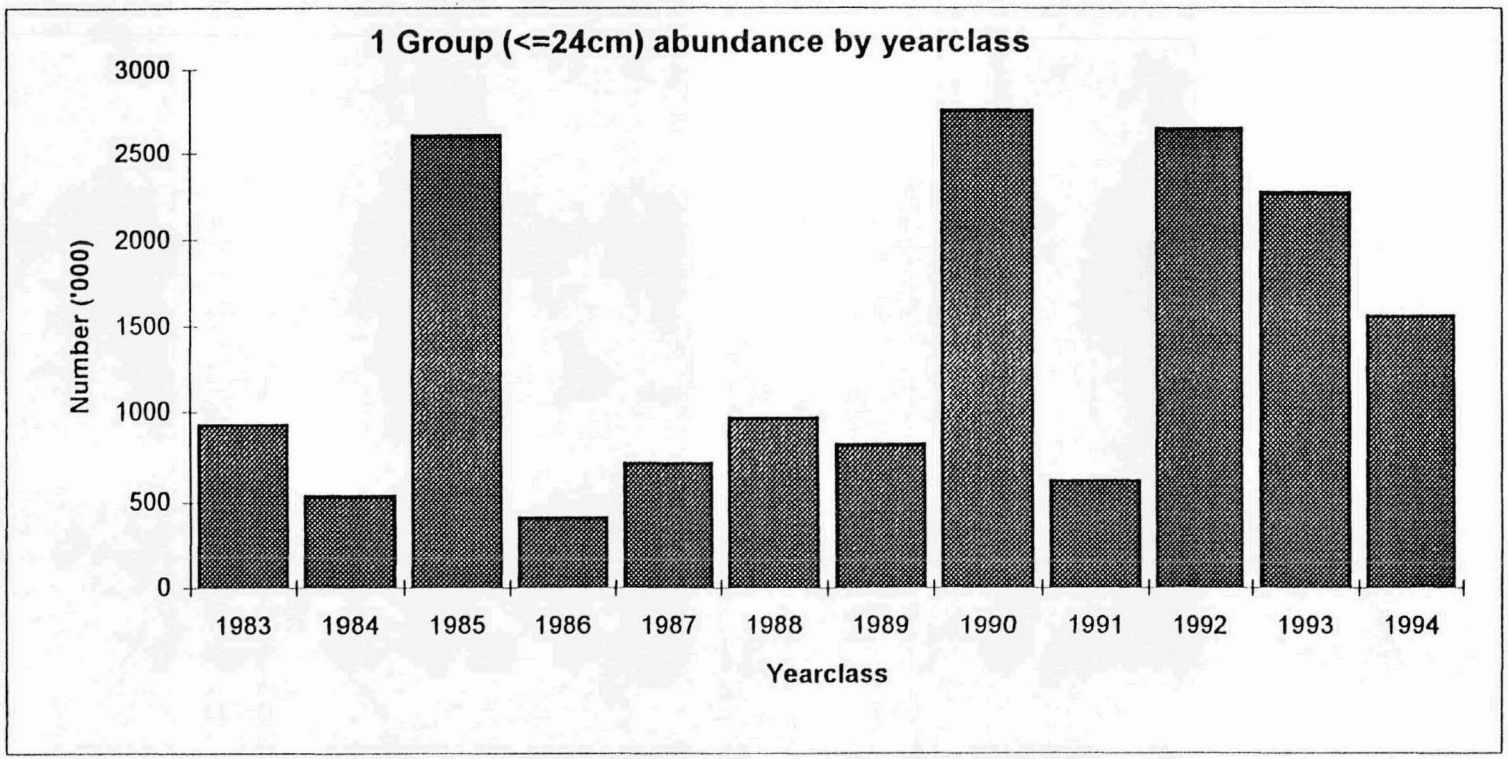


Figure 5.1.2

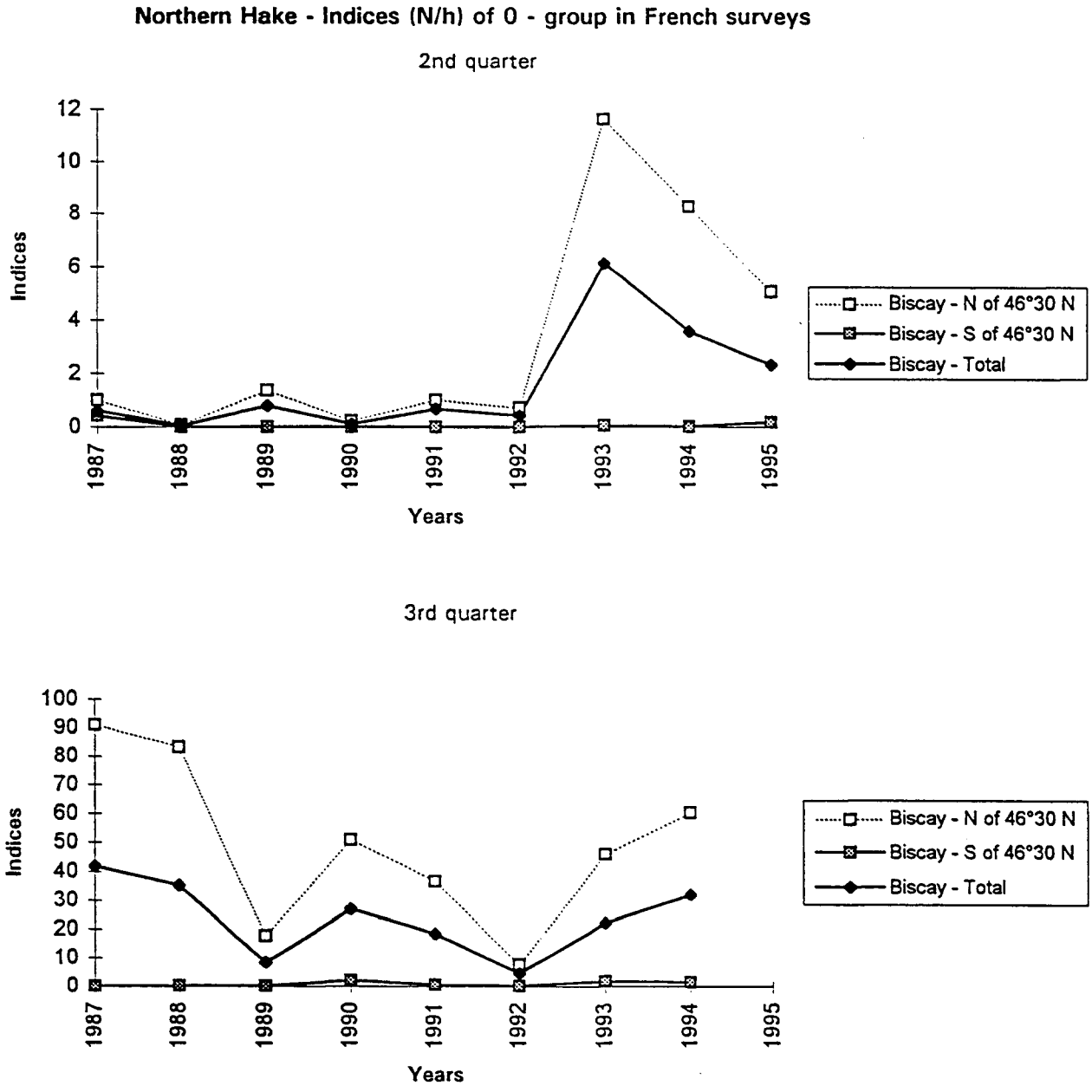

Northern Hake - Indices (N/h) of 0 - group in French surveys
2nd quarter
Indices
Years
Biscay - N of 46°30 N
Biscay - S of 46°30 N
Biscay - Total
3rd quarter
Indices
Years
Biscay - N of 46°30 N
Biscay - S of 46°30 N
Biscay - Total

Figure 5.1.3

Northern Hake. Indices (number per haul) of 0 - group in EVHOE surveys.